FIAT Uno Turbo i.e.

with Antiskid Brake System from AP

The "Antiskid" brake system made by the English company "Automotive Products plc" is at the present time only installed in the Fiat Turbo i.e., but it may well start being fitted to other sub-compact cars in the near future.

With respect to its structural complexity and its price, it belongs to the simple group of systems which is suitable for small and mid-sized, front-wheel-drive cars.

In contrast to the SCS of the Ford Escort, the AP system does not, however, operate purely mechanically, but is equipped with wheel-speed sensors and an electronic control unit. In order to keep the design as simple and as inexpensive as possible, the technicians of the English manufacturer have equipped only the front wheels with speed sensors.

Each of the rear wheels are connected in the diagonally split brake circuits to the front wheel on the opposite side of the car.
In this way, they are not actually controlled individually, but they, nevertheless, are controlled dependent on the front wheels.
Each rear wheel is equipped with a separate brake-pressure regulator.

Components of the system

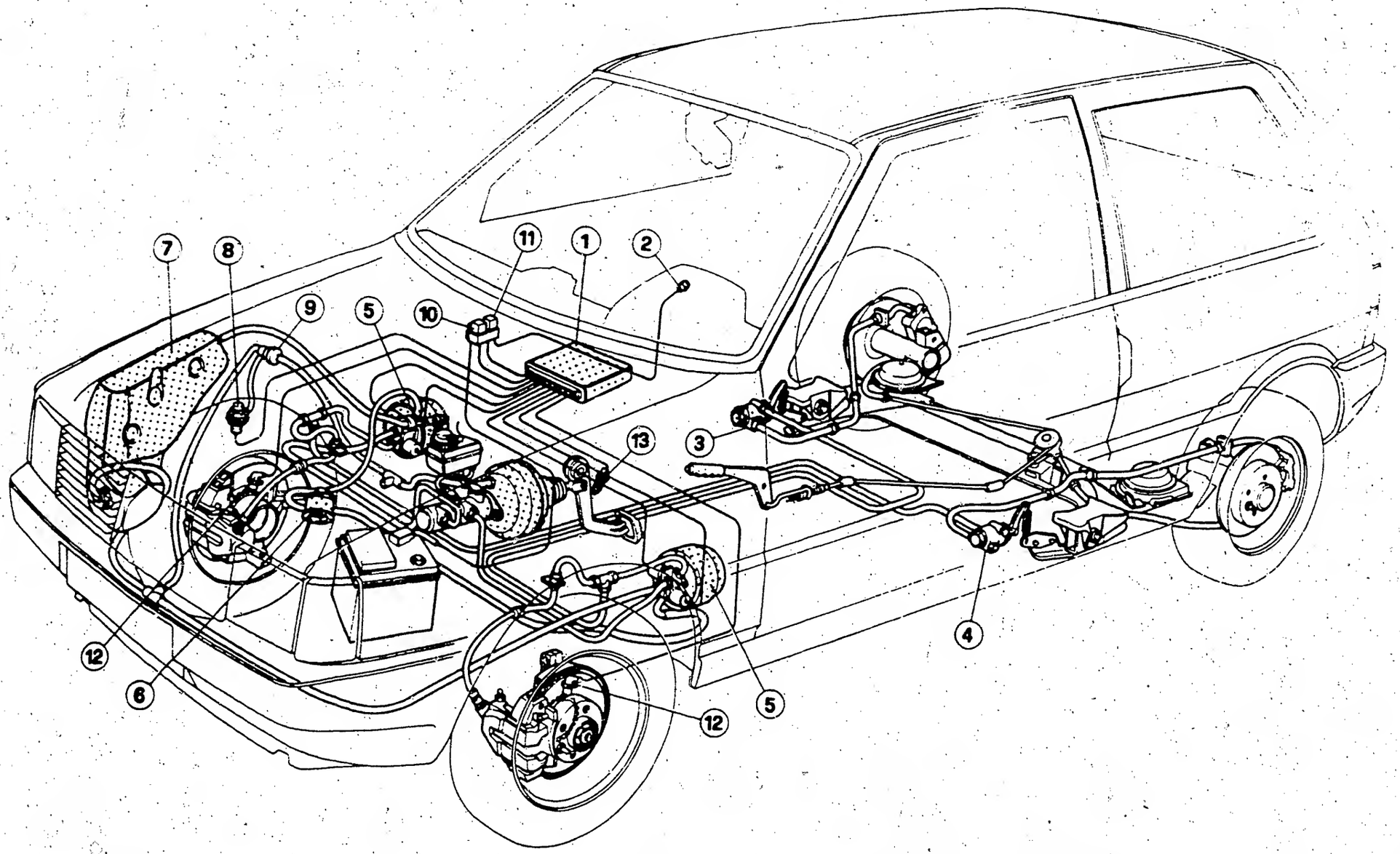
Two wheel-speed sensors (induction-type pulse generators) installed at the front wheels supply the electronic control unit with the necessary details concerning the slip ratios at the front wheels required for control. Logic commands are then passed from the control unit to the solenoid-operated valves of the pressure modulators.

These modulators are installed beneath the fenders and regulate the brake-fluid pressure in the wheel-brake cylinders of the disc-brake calipers by means of vacuum if a front wheel locks.

The required vacuum is tapped from the intake manifold of the engine and is stored in a vacuum reservoir. This guarantees a supply of vacuum even at higher speeds (full throttle, acceleration). A non-return valve is installed in the line between the intake manifold and the vacuum chamber.

Insufficient vacuum reserve is detected by a vacuum-control switch and indicated by a warning lamp.

The athmospheric air required for pressure modulation is fed to the pressure modulators through a special air filter.



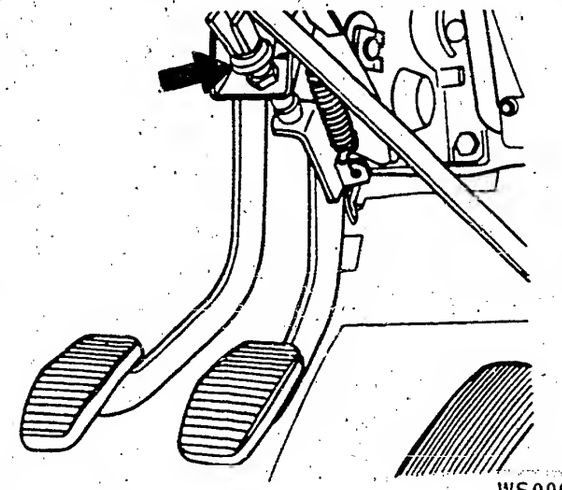
WS000104

The components of the antiskid system

1 = Control unit
2 = Warning lamp
3 = Brake-pressure regulator for rear wheels
4 = Brake-pressure regulator for rear wheels
5 = Pressure modulator
6 = Air filter
7 = Vacuum reservoir
8 = Vacuum-control switch
9 = Non-return valve
10 = Relay for control-unit power supply
11 = Relay for warning lamp
12 = Wheel-speed sensor
13 = Brake-pedal switch

A stop-lamp switch positioned above the brake pedal (upper illustration) simultaneously activates switching on of the anti-skid system and lighting up of the stop lamps as the brake pedal is depressed.

An indicator lamp in the instrument panel (lower illustration) lights up immediately after the engine is switched on, while the control unit conducts a rapid self-test, and goes out again - if the system is O.K. - as soon as the vehicle has exceeded a road speed of 8 km/h (5 mph).



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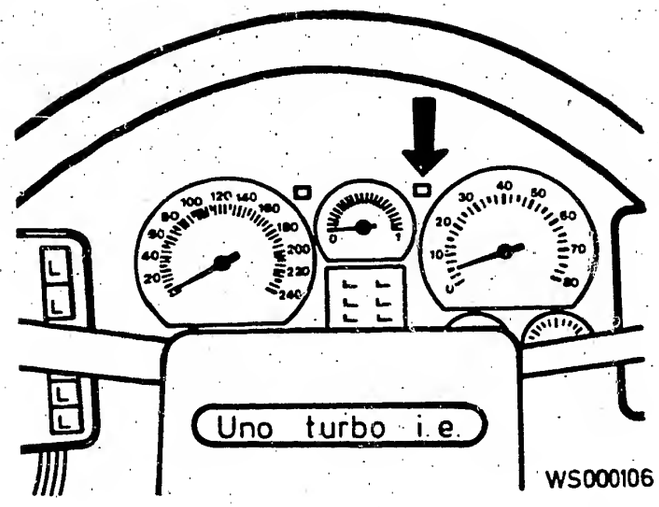

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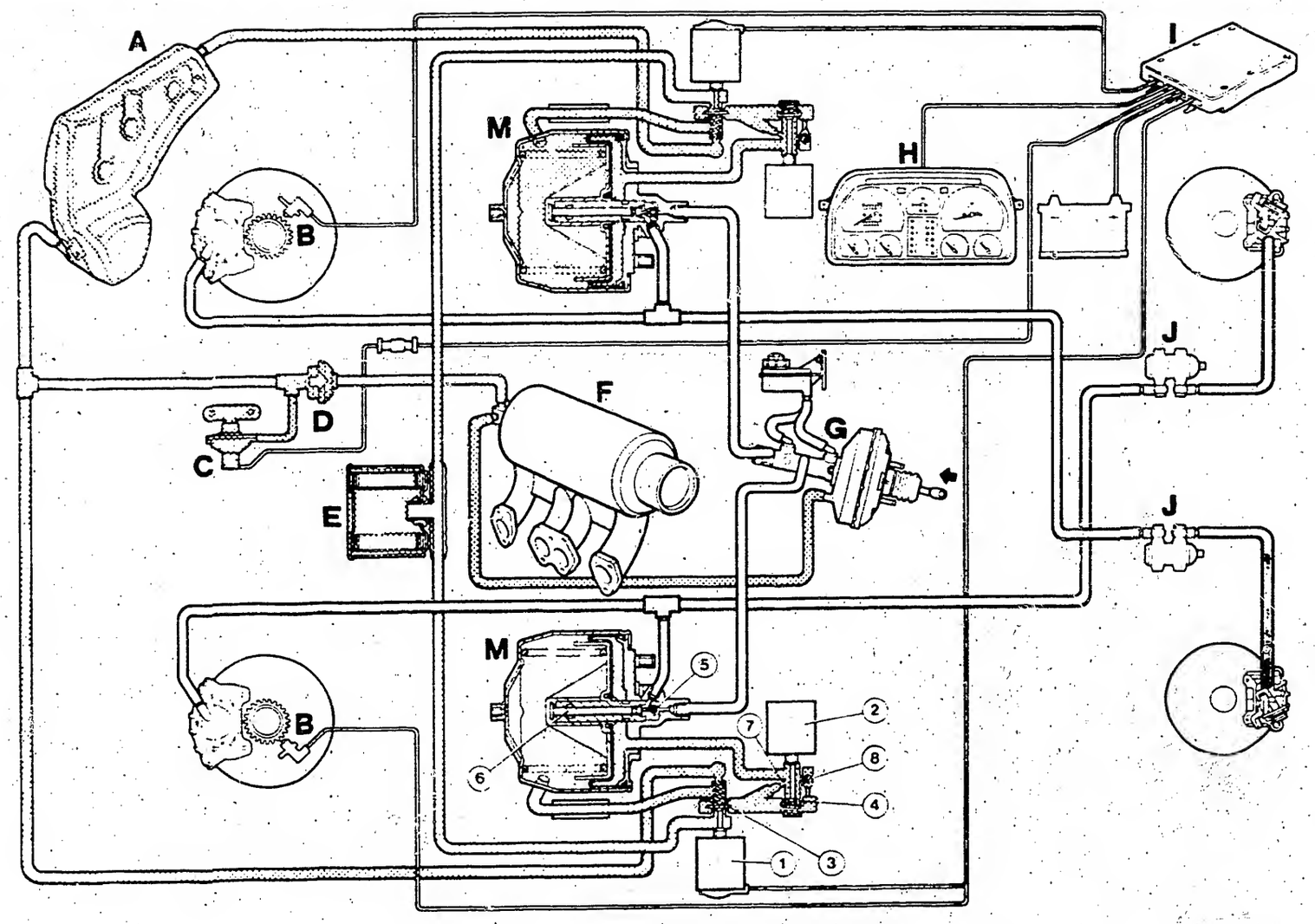
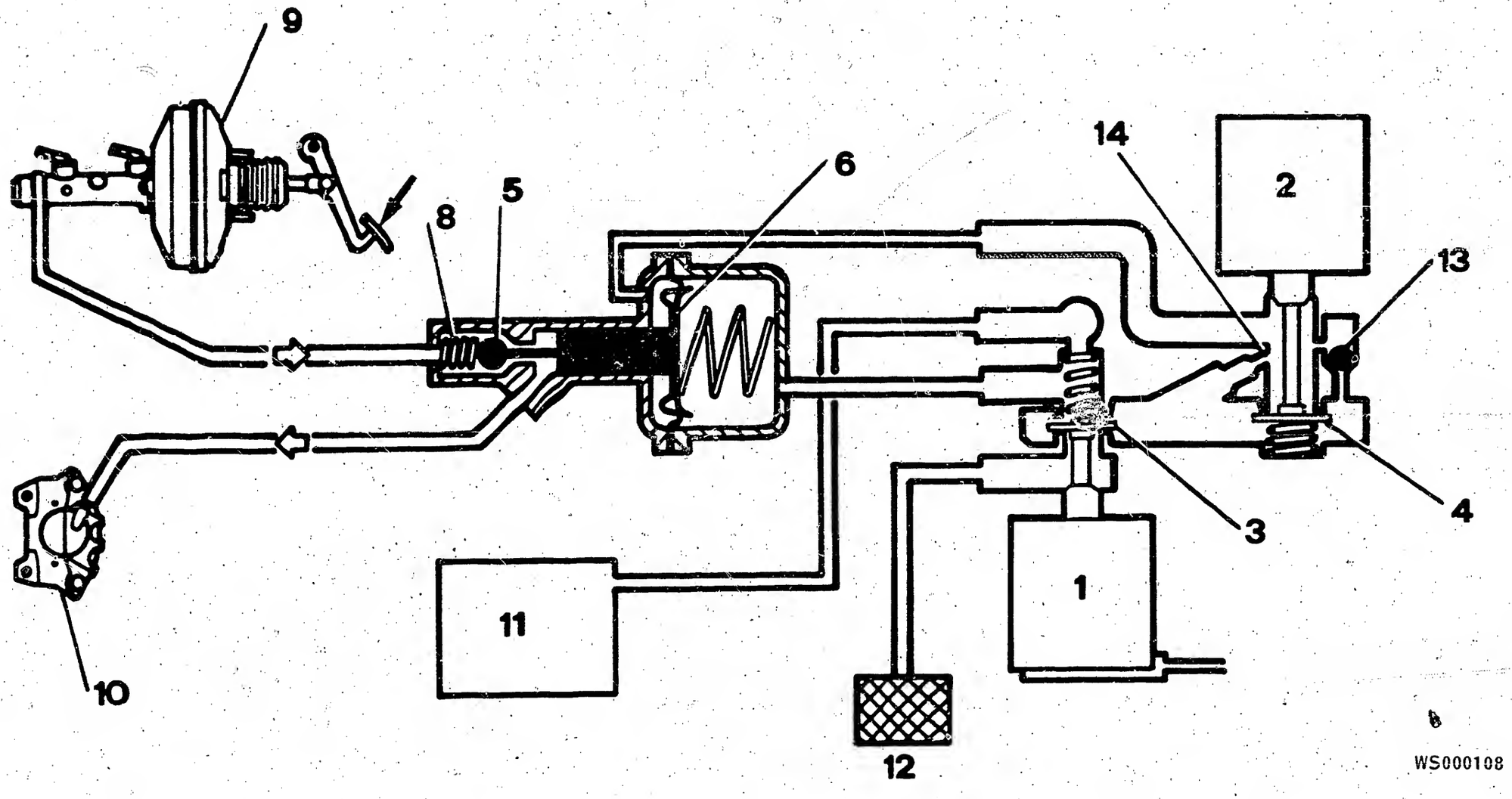


WS000107

Schematic diagram of the system:

A = Vacuum reservoir
B = Wheel-speed sensor with ring gear
C = Vacuum-control switch
D = Non-return valve
E = Air filter
F = Intake manifold
G = Brake power-assist unit
H = Instrument cluster
I = Control unit
J = Brake-pressure regulator
M = Pressure modulator with solenoid-operated valves (1) and (2)
spring-loaded valves (3) and (4)
ball-type shutoff valve (5)
piston (6)
restriction bore (7)
and ball valve (9)



WS000108

Diagram of the antiskid system with pressure modulator without pressure regulation:

1 = Solenoid-operated valve (1)
2 = Solenoid-operated valve (2)
3 = Valve closed
4 = Valve open
5 = Ball valve open
6 = Vacuum diaphragm
8 = Compression spring
9 = Brake power-assist unit and brake master cylinder
10 = Front disc-brake caliper
11 = Vacuum reservoir
12 = Air filter

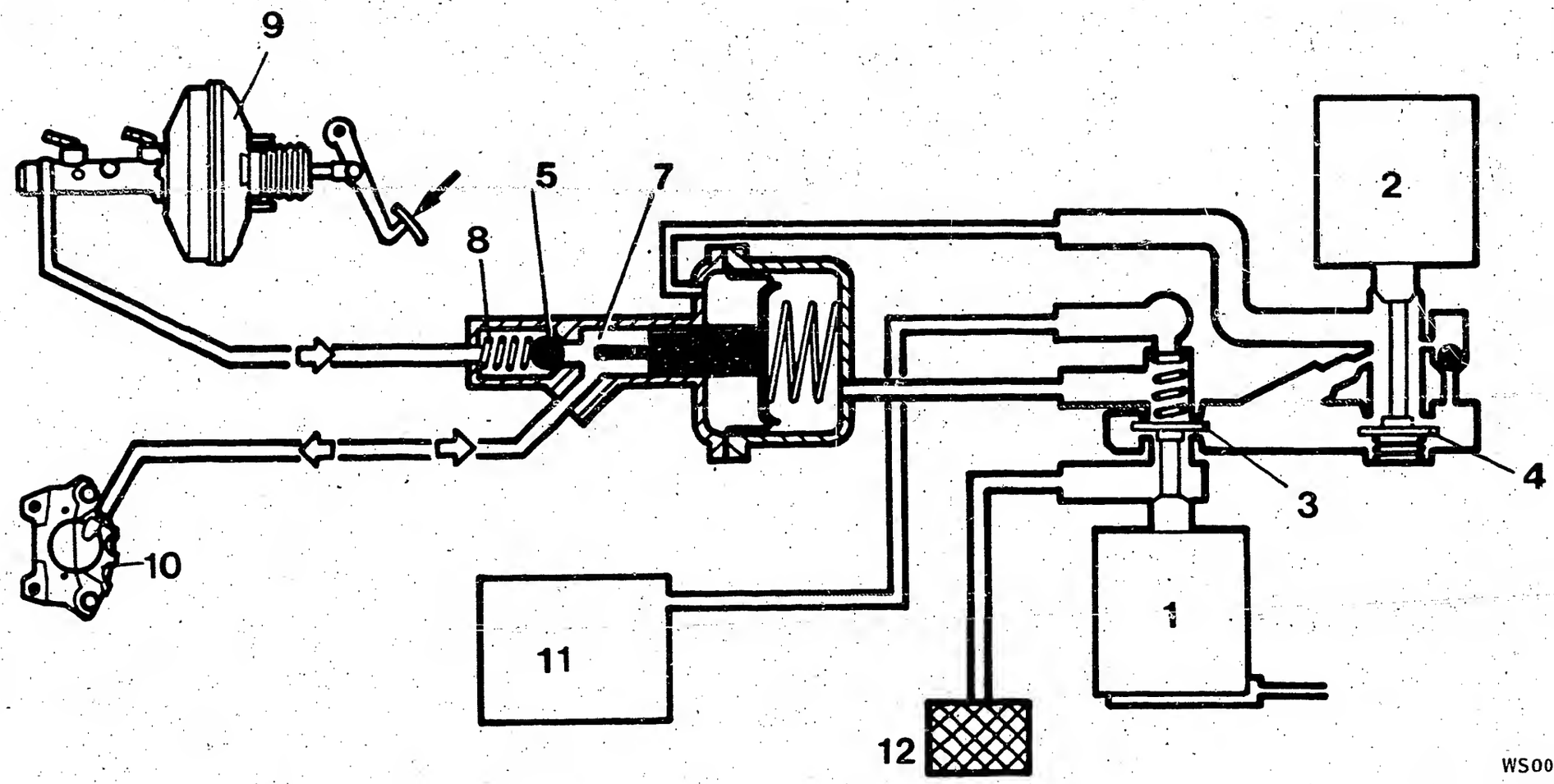


Diagram of the antiskid system with pressure modulator under pressure regulation:

1 = Solenoid-operated valve (1)
2 = Solenoid-operated valve (2)
3 = Valve closed
4 = Valve open
5 = Ball valve closed
6 = Vacuum diaphragm
7 = Pressure reduction through expansion of volume in pressure reservoir
8 = Compression spring
9 = Brake power-assist unit and brake master cylinder
10 = Front disc-brake caliper
11 = Vacuum reservoir
12 = Air filter

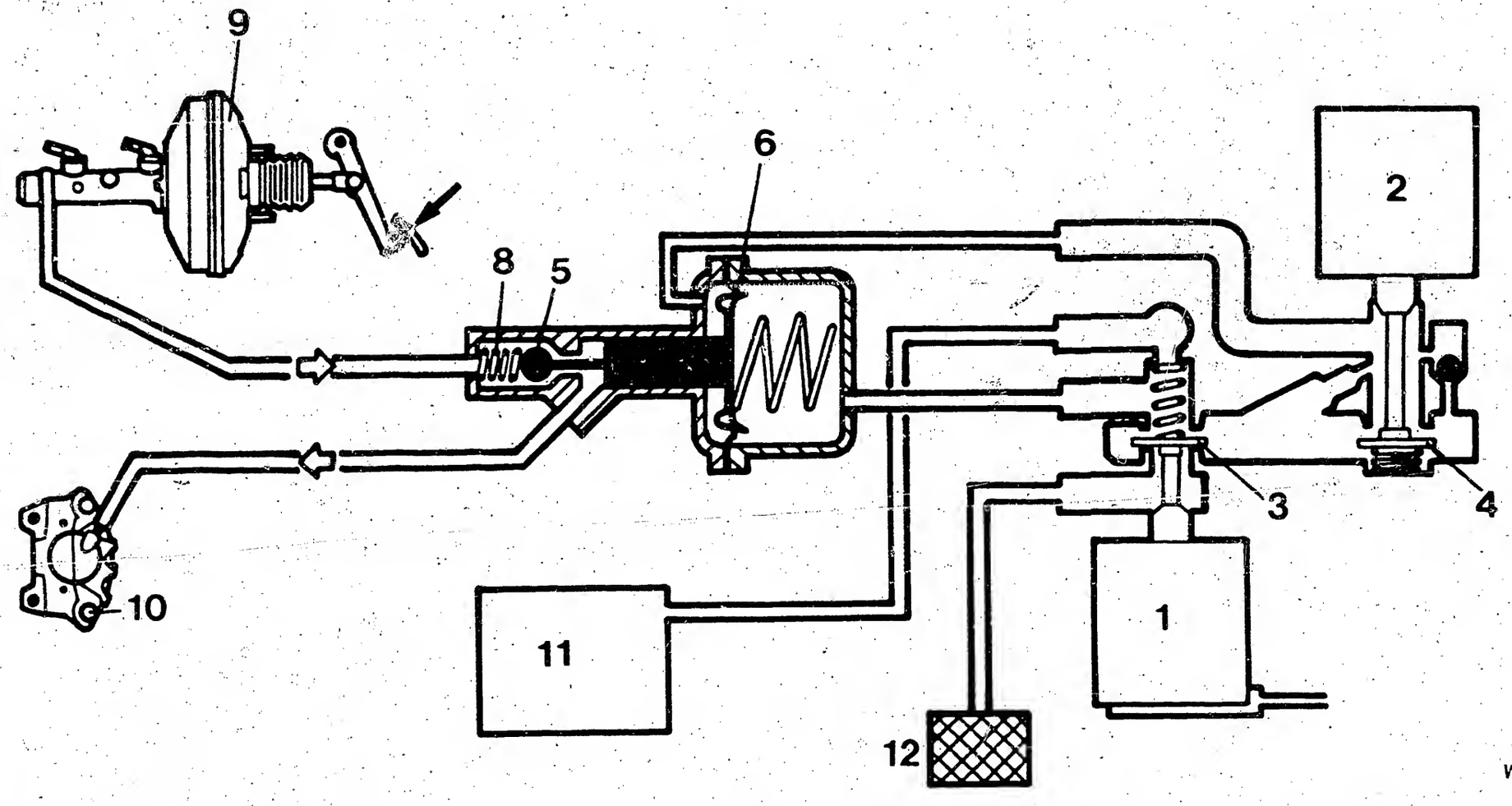
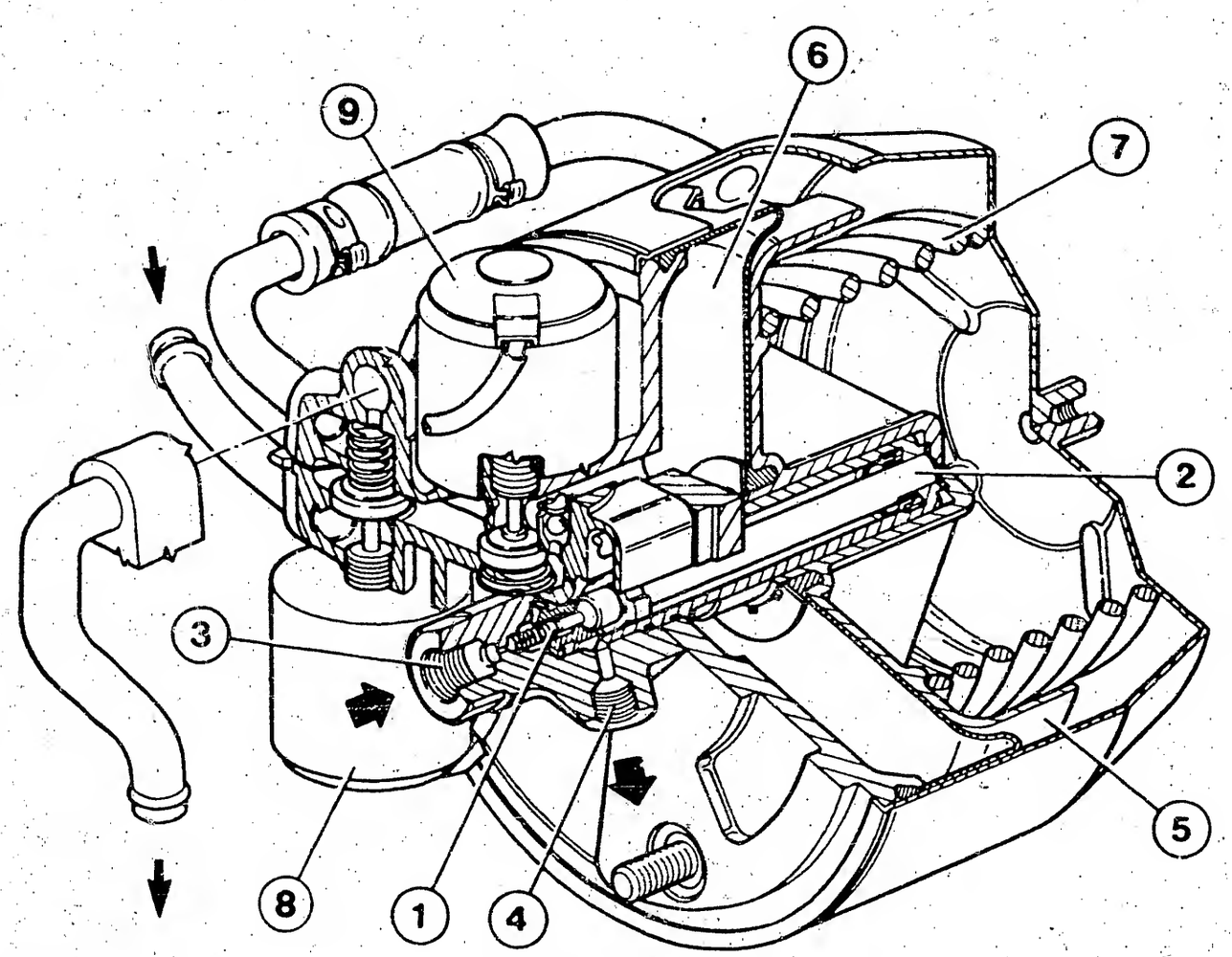


Diagram of the antiskid system with pressure modulator under pressure build-up:

1 = Solenoid-operated valve (1)
2 = Solenoid-operated valve (2)
3 = Valve closed
4 = Valve open
5 = Ball valve open
6 = Vacuum diaphragm
8 = Compression spring
9 = Brake power-assist unit and brake master cylinder
10 = Front disc-brake caliper
11 = Vacuum reservoir
12 = Air filter



WS000111

Cross-section through the pressure modulator

1 = Ball valve
2 = Piston
3 = Inflow from brake master cylinder
4 = Outflow to the wheel-brake cylinders
5 = Spring-loaded diaphragm plate
6 = Diaphragm
6 = Spring
8 = Electro-magnetic air/vacuum regulating valve, first stage
9 = Electro-magnetic air/vacuum regulating valve, second stage

Regulation in the pressure modulator

A pressure modulator is assigned to each front-wheel brake.

As long as "danger of locking up" is not reported by the control unit, the piston (Item 6) remains in the neutral position, because the same pressure (vacuum) prevails in the two chambers of the pressure modulator and the spring of the piston is forced to the left.

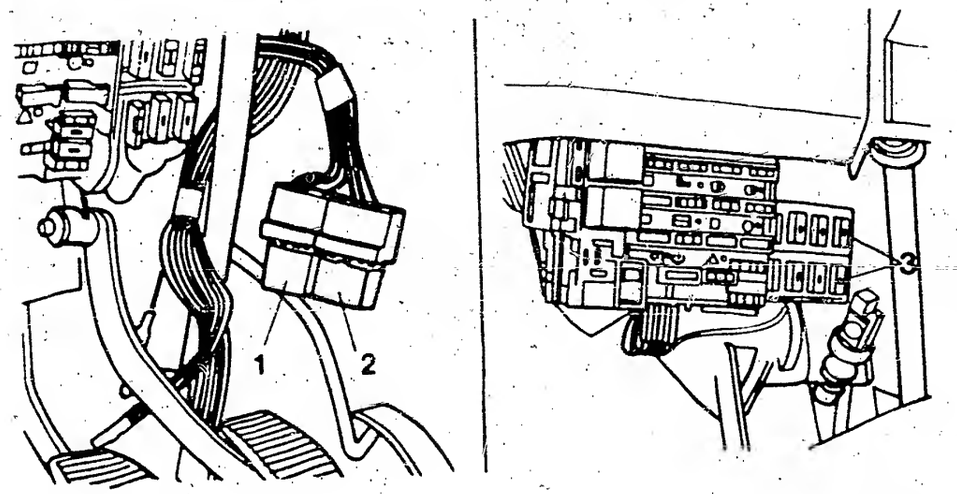
In this piston position, the ball valve is open and the hydraulic pressure exerted by the brake master cylinder is passed without any hindrance into the wheel-brake cylinders of the disc-brake calipers.
At this time, the solenoid-operated valves (1 and 2), which control the supply of atmospheric pressure to the pressure modulators, remain de-energized.

The springs (3 and 4) keep the valves closed; vacuum prevails in the two chambers of the pressure modulators.
If the solenoid-operated valve (1) is activated by the control unit, the valve opens and permits the atmospheric pressure to flow into the inner cylinder halves via the ball valve (13) and the calibrated bore (14).
The piston in the pressure modulator begins to be displaced to the right opposed to the spring pressure.
When the piston has been displaced sufficiently, the spring (8) closes the ball valve (5). This interrupts the fluid pressure coming from the brake master cylinder which means that it can no longer act on the wheel-brake cylinders.
If the diaphragm (6) moves further to the right, the volume of the chamber (7) is expanded.
This reduces the fluid pressure in the shut-off system and thus also in the wheel-brake cylinder. The wheel begins to rotate faster again. The driver does not feel any reaction at the brake pedal while this is going on, because the front section of the brake circuit is completely closed off by the ball valve.

Thanks to the design with two solenoid-operated valves per pressure modulator, it is possible to modify the speed of the pressure reduction and of the pressure build-up in the wheel-brake-cylinder-side section of the brake circuit.
This provides sensitive, rapidly responding regulation in the limit range of lock-up.
If, for example, the second solenoid-operated valve (2) is additionally opened for reducing the pressure in the hydraulic system, more atmospheric air enters the inner chamber of the pressure modulator and the piston is moved more rapidly to the right. In other words, the volume expansion of the brake circuit on the wheel side is accelerated.

Conversely, pressure build-up in the still shut-off hydraulic system is slower if only the valve (2) is open, and more rapid if both solenoid-operated valves (3 and 4) allow atmospheric air to flow into the chamber.

The air pressure that results from the interaction of the control valves (1 and 2) and which acts on the piston (6) determines, then, the brake-fluid pressure in the wheel-brake cylinder of the corresponding wheel when antiskid regulation is initiated.

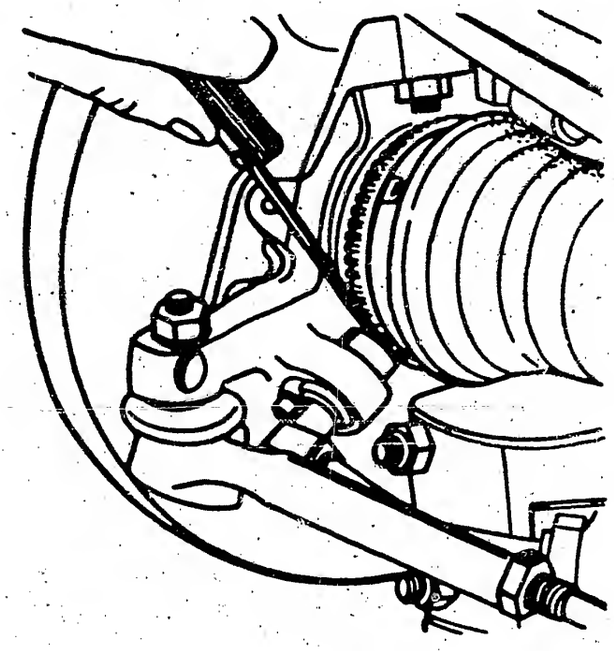


WS000112

1 = Warning-lamp relay
2 = Power-supply relay of the control unit
3 = Fuses

The fuses and relays of the antiskid system are accommodated in the footwell on the driver's side (upper illustration).

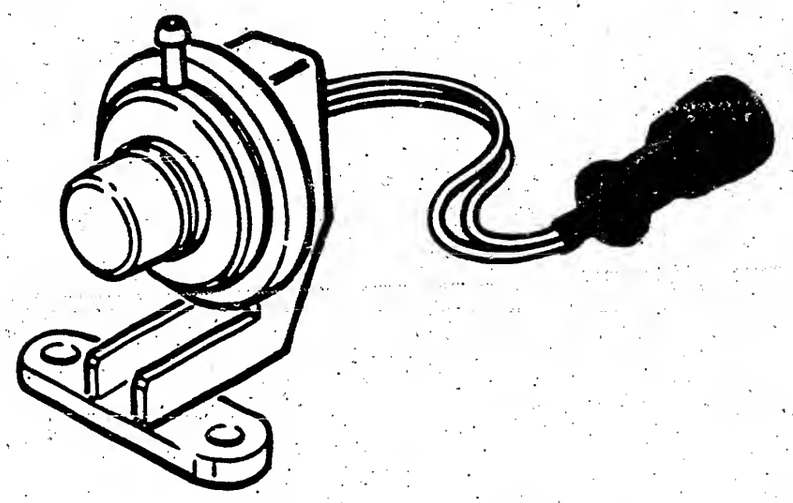
The power-supply side of the supply relay is protected by a 25 A fuse and the control-current side by a 10 A fuse.



WS000113

Testing the clearance of the wheel-speed sensor to the ring gear.

The wheel-speed sensors are installed rigidly in the steering knuckle supports.
Their clearance to the ring gears mounted on the drive shafts cannot be adjusted due to the design.
The clearance must be between 0.25 and 0.95 mm.



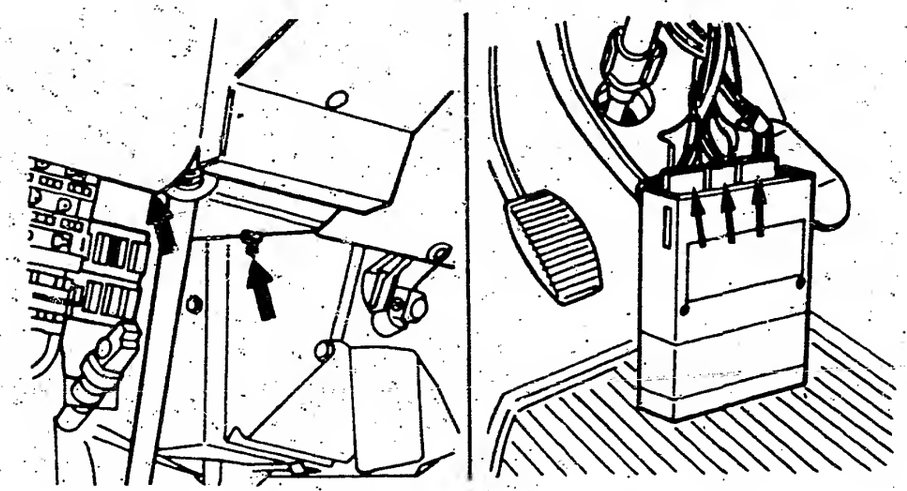
WS000114

Vacuum-control switch

The vacuum-control switch, that informs the control unit of the vacuum reserve in the vacuum reservoir, is accomodated in the engine compartment.
It must switch on the indicator lamp of the anti-skid system if the vacuum falls below 400 mbar.
The brakes remain in this state fully effective, but without antiskid regulation.

The air filter must be replaced after three years or 60 000 km (37 500 miles).
It must be noted that neither the pressure modulators nor the vacuum reservoir may be subjected to particularly high temperatures.

The maximum values amount to 85° C (pressure modulator) and 80° C (vacuum reservoir).



WS000115

The control unit is located beneath the steering column in the footwell (left-hand illustration).

Access can be gained to it by loosening the two bolts marked with an arrow.

Once the control unit has been removed (right-hand illustration), the 3 plugs (arrows) can be removed easily.

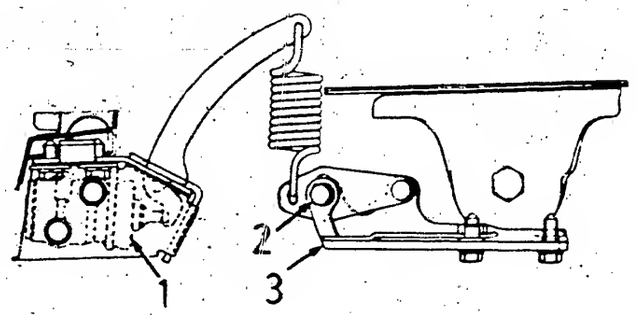
Location of the brake-pressure regulators for the rear-wheel brakes on both sides on the vehicle floor panel (outside) immediately in front of the rear-axle mounts (upper illustration).

The suspension components must be O.K. if the brake-force regulators of the rear-wheel brakes are to be adjusted.

Furthermore, the vehicle must be fit and ready for driving and be parked on a completely horizontal surface with its full weight on the wheels.

A weight of 45 kg must be deposited next to the front panel of the luggage compartment.

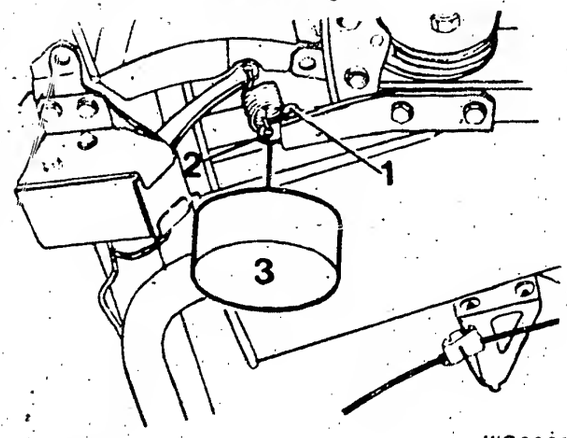
With these preparations taken, the setting screw 1 (lower illustration) is finally loosened and a weight of 10 to 11 kg secured to the hook (2).
Then retighten the screw in this position.
The same setting procedure must be repeated for the second brake-force regulator.



WS000116

1 = Brake-pressure regulator
2 = Setting screw
3 = Front section of the trailing arm – trailing-arm mount

1 = Setting screw
2 = Retaining clip
3 = Test weight



WS000117

Before tackling repair work or replacing brake linings, the three connectors on the electronic control unit (upper illustration) must be disconnected.

The terminals on plug 1:

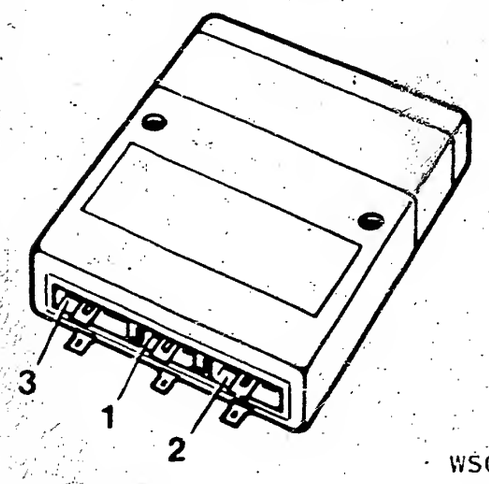
1 = (BL) Warning-lamp switch
2 = (BV) Warning-lamp switch
3 = (BC) Terminal 86
4 = (HR) Terminal 85
5 = (BR) Terminal 87
6 = (B) Terminal 87

The terminals on plug 2:

1 = (V) Wheel-speed sensor, right
2 = (B) Wheel-speed sensor, right
3 = unassigned
4 = (LB) Pressure modulator, right
5 = (LG) Pressure modulator, right
6 = (LR) Pressure modulator, right
7 = (LV) Pressure modulator, right
8/9/10 = unassigned

The terminals on plug 3:

1 = (V) Wheel-speed sensor, left
2 = (B) Wheel-speed sensor, left
3 = unassigned
4 = (C) Pressure-modulator, left
5 = (GN) Pressure-modulator, left
6 = (GR) Pressure-modulator, left
7 = (GV) Pressure-modulator, left
8/9/10 = unassigned



WS000118

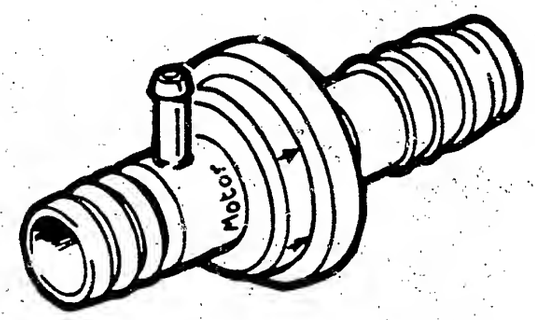
Electronic control unit

Important: Only the brake linings released for use by the manufacturer may be used. The reason for this is that the brake-pressure regulator is matched to a specific type of brake lining. Lingings with different friction characteristics could adversly affect the efficiency and stability of the brakes.

Bleed the hydraulic system in the usual, conventional manner after working on hydraulic components and whenever you suspect that there is air in the system.

The vacuum hoses of the antiskid system must comply with specific requirements. Therefore, only original vacuum hoses may be used. If unsuitable hoses are used, this could reduce the performance and perfect operation of the antiskid system.

Most of the components of the pneumatic-hydraulic system, such as the air filter, brake-force regulator, brake-pressure regulator, non-return valve (upper illustration), and vacuum reservoir, as well as most of the electronic components cannot be reconditioned, but must be replaced by new components if defective.



WS000119

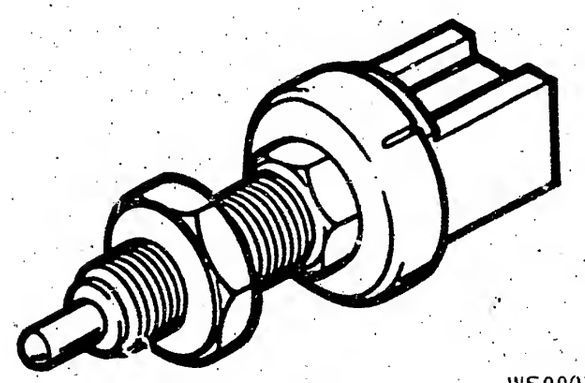
The non-return valve is installed in the vacuum line that leads from the intake manifold to the vacuum reservoir

Malfunctions and diagnostics

The brake-pedal switch fulfills two functions. On the one hand, it must switch on the stop lamps and on the other hand, the antiskid control system.
This means that the control system is activated only once braking has begun. It is important that the pedal switch is always set correctly. If this is not the case, movements of the brake pedal may lead to stuttering of the brakes.
The fact that the pedal switch is switched on is not indicated to the driver by means of the warning indicator lamp. Should the brakes ever suffer from stutter, always check the pedal switch and its setting first of all.

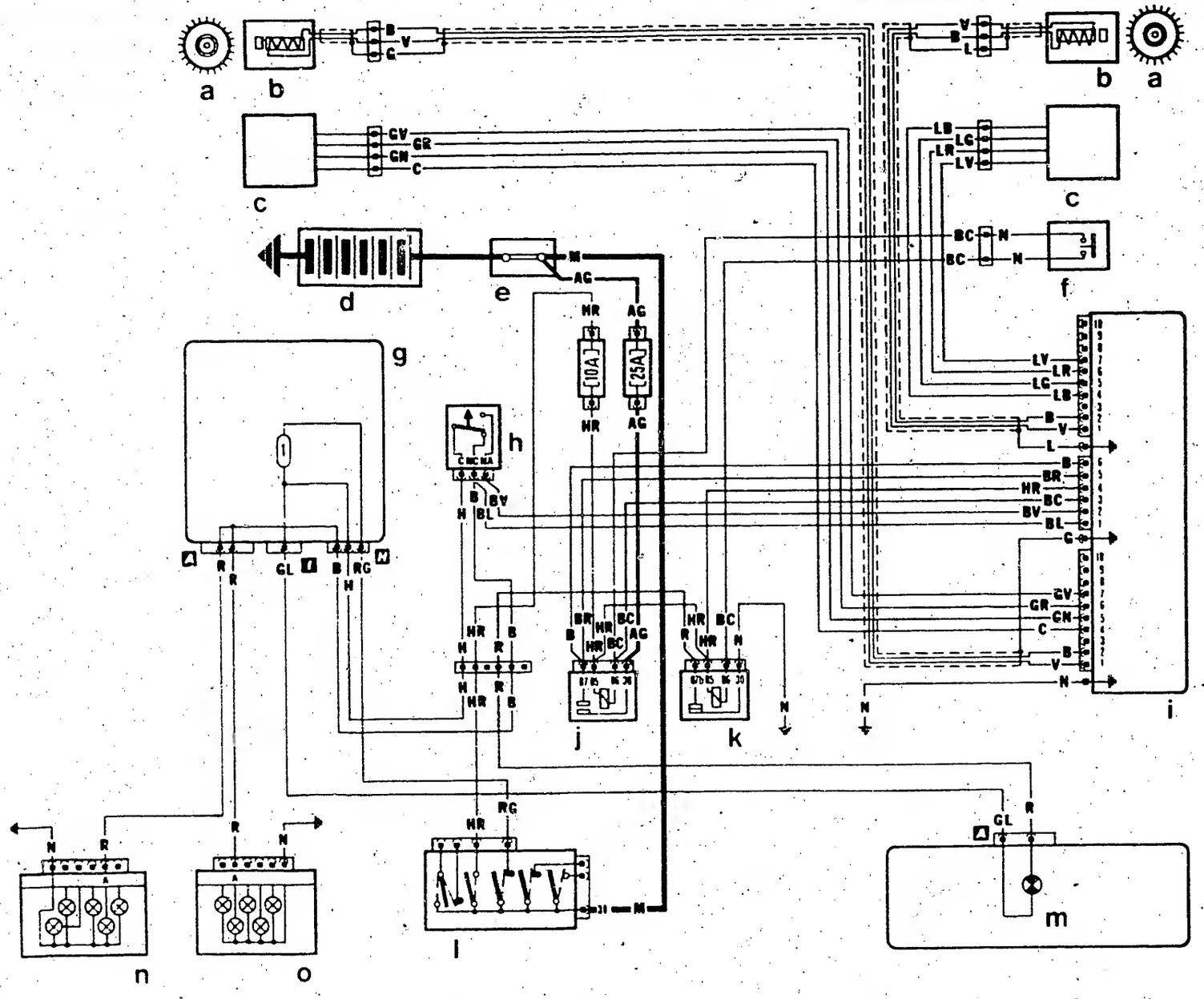
Any malfunctions that occur in the antiskid system are indicated by the indicator lamp while the car is being driven or after starting if the lamp does not go out. In such a case, the hydraulically actuated brakes continue to operate along conventional lines, but without the antiskid system.

A special FIAT PRO/1 tester is available for trouble-shooting and gauging the electronic control system, the tester being used in conjunction with the interface cable A.P. With the aid of the diagram in the illustration (see coordinates 3/4) the individual components can be gauged and tested with regard to continuity, but also using a common multimeter.



WS000120

Brake-pedal switch



Circuit diagram of the AP Antiskid System

a = Ring gear
b = Wheel-speed sensor
c = Pressure modulator
d = Battery
e = Distributor plug
f = Vacuum switch
g = Distributor centre
h = Stop-lamp switch
i = Control unit
j = Relay, control-unit power supply
k = Relay for warning lamp
l = Ignition switch
m = Warning lamp
n = Taillight, left
o = Taillight, right

Test data for the AP Antiskid System

Resistance of the wheel-speed-sensor coils = 335 Ω

Pulses of the wheel-speed sensors at 30 km/h = > 8

Resistance of the pressure-modulator coils (valves 1 and 2) = 2.6...4.2 Ω

Test points: Term. 4 and 7 of the left-hand plug
Term. 5 and 7 of the left-hand plug
Term. 4 and 6 of the right-hand plug
Term. 5 and 7 of the right-hand plug

Test data for the AP Antiskid System (Continued)

Insulation of the pressure-modulator coils to ground = infinity Ω

Specified voltage at stop-lamp switch with ignition switched on = > 11 V

Specified voltage at term. 1 of the center plug with ignition switched on and brake pedal actuated = > 11 V

Specified voltage between term. 4 of the center plug and ground = > 11 V

Specified voltage between term. 3 and 5 of the center plug = > 11 V

Max. permissible resistance between chassis connection, control unit and battery (-) = < 1 Ω

Max. permissible ressistance between term. 5 and 6 of the center plug = 0.8 Ω

Important note:

The control unit and pressure reservoir must not be subjected to temperatures that exceed 80...85° C.

This microcard was prepared exclusively for Bosch Service on behalf of ROBERT BOSCH GMBH STUTTGART

J. Pfyl-Ing. HTL
Ingenieurbüro für Auto-Technik

Drawn up on the basis of a publication by the same author which appeared in the "Auto-Technik" magazine published by the AT-Fachschriftenverlag AG, CH-5001 Aarau.

The BOSCH equipment and the test specifications/ settings for BOSCH products and components are always to be taken from the BOSCH microcards. Test specifications and circuit diagrams are contained in the microcards and workshop documentation already introduced into BOSCH after-sales-service workshops.

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RENAULT 21 1.7, 65/56 kW, engine F2N 710/712
1.7i Cat. 54/65/70 kW, engine F2N (F3N)

1. Design and function

The Renix ignition system (AEI) is fully electronic. The flywheel is provided with gear teeth (40 teeth). Two additional teeth are twice as wide and offset by 180° with respect to one another. These are used to determine the TDC position, whereas the normal teeth indicate the engine speed to the control unit by way of the pulse generator with permanent magnet and induction coil permanently attached to the housing.

The control unit uses the engine speed and intake-manifold vacuum to calculate the most favorable ignition point and informs the electronic ignition module as to certain corrections and special conditions.

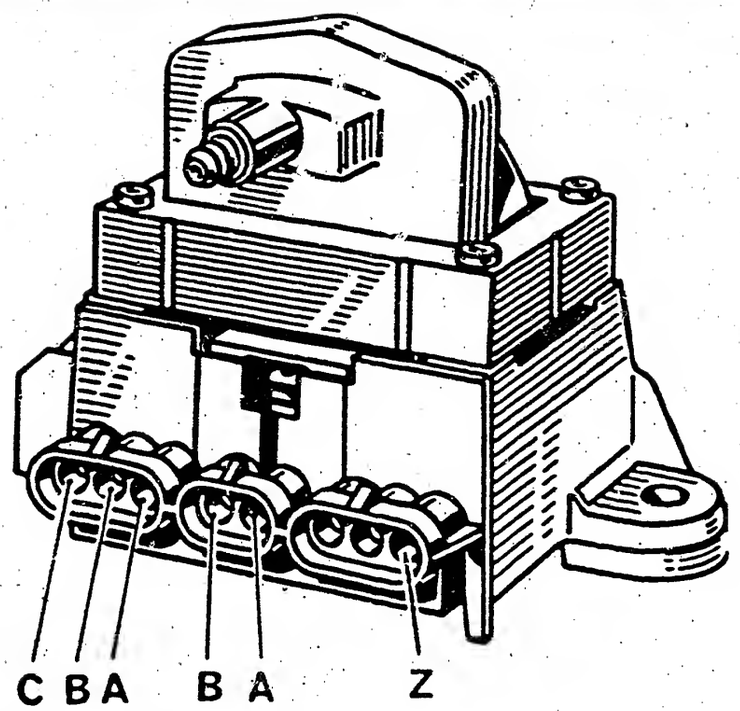
The rev counter is also connected to the ignition module.

2. Safety instructions

- Never allow high voltage to spark over on to the electronic ignition module.
- Do not connect primary and secondary connections of ignition coil to ground.
- Never start engine with battery connections detached.
- Never start using fast charger.
- Never disconnect battery with engine running.
- Remove control unit at temperatures in excess of 80°C (stove enamelling).
- Disconnect battery before performing electrical welding work.
- Neither disconnect nor connect control-unit plug with ignition switched on.

C01 — ⟹

C02 — ⟺



WS000145

A = Battery +
B = Ground
C = Rev-counter twin plug with B pulse generator
Z = Connection, coolant sensor

3. Components of ignition system

In the case of engines where there is neither fuel injection nor a catalytic converter, the ignition control unit is replaced by an ignition coil with power output stage and triple connector (top picture).

The map control for the ignition system is only integrated into the injection control unit in the case of the engine version with fuel injection and catalytic converter.

This control unit is installed at the left-hand wheel house in the engine compartment.

C03 — <⟹>

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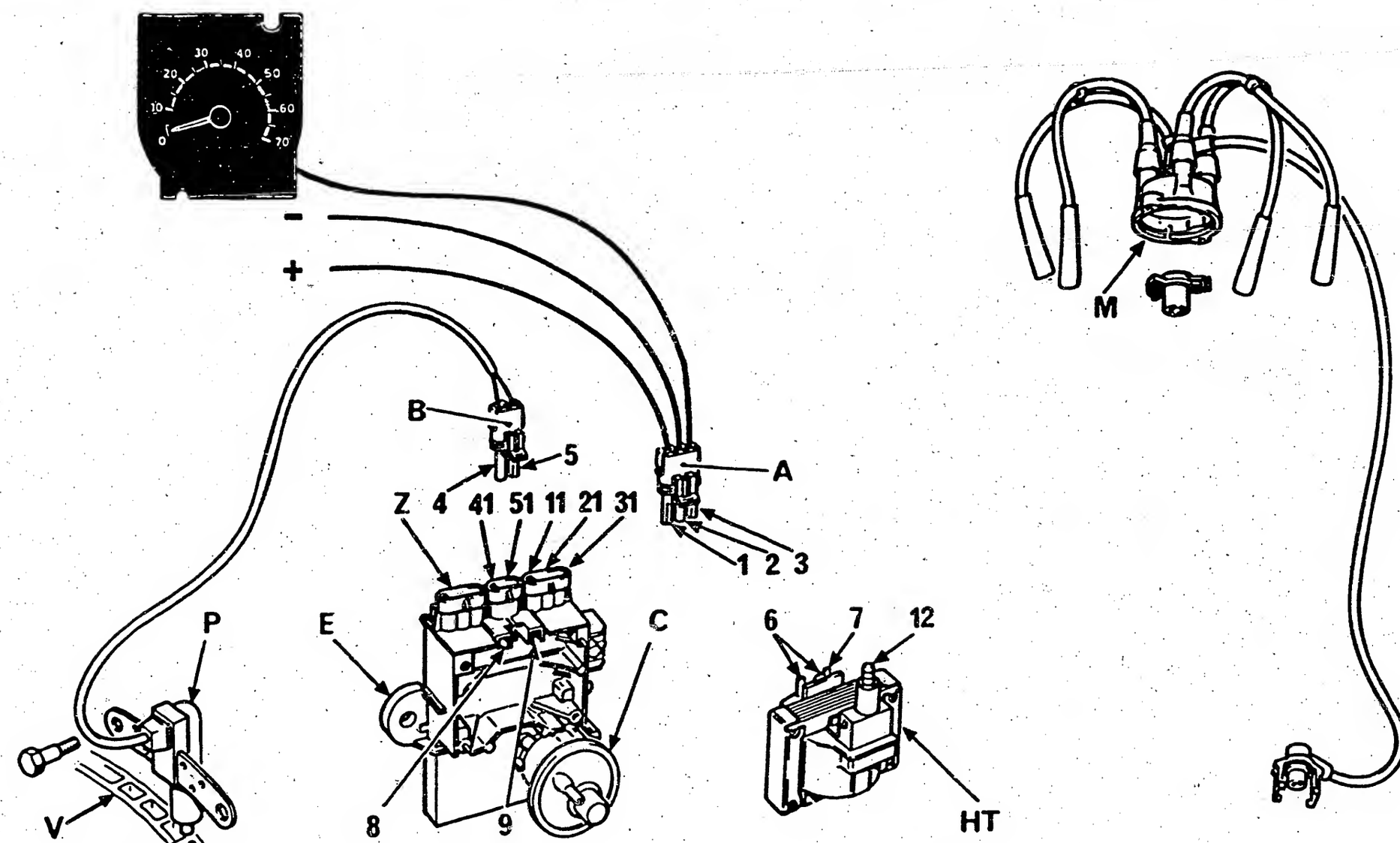
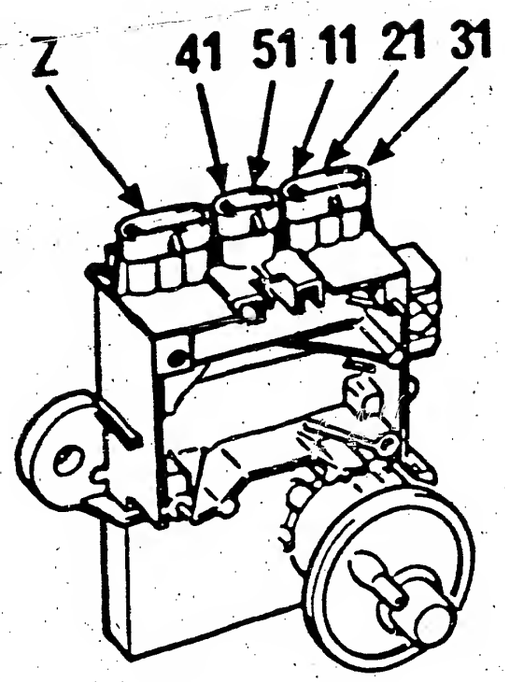
continued on the following coordinate.

C04 — <⟹>



WS000143

1 = Current supply +
2 = Ground
3 = Rev counter
4 = Pulse generator
5 = Pulse generator
6 = Terminal, ignition coil + and interference-suppression capacitor
7 = Terminal, ignition coil -
8 = Contact, ignition coil +
9 = Contact, ignition coil -
11 = Power supply, ignition module +
12 = H.T. connection
21 = Ignition module ground
31 = Output, rev counter
41 = Input, pulse generator
51 = Input, pulse generator
A = Triple connector
B = Pulse-generator plug
C = Vacuum unit
E = Ignition control unit
M = Distributor cap
P = Pulse generator
V = Flywheel
Z = Connection, temperature sensor

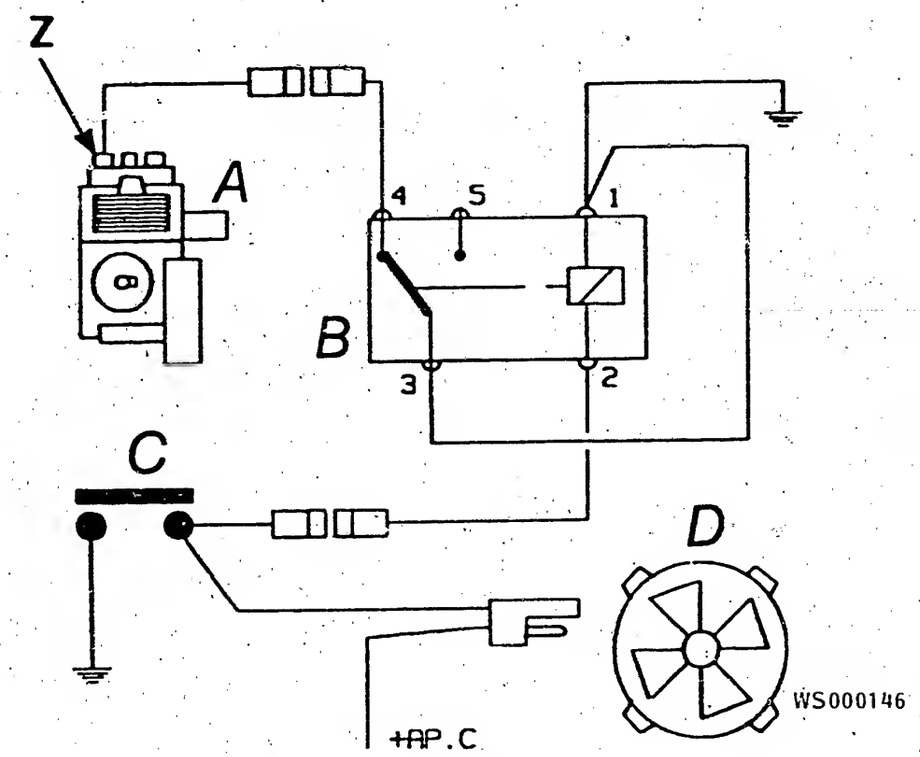


WS000195

The ignition control unit features two additional connections by way of which correction functions triggered by two temperature sensors are input.

Connection A in the socket Z (top picture) is connected by way of a lead to the cooling-fan relay, which, in turn, is actuated by a coolant sensor.

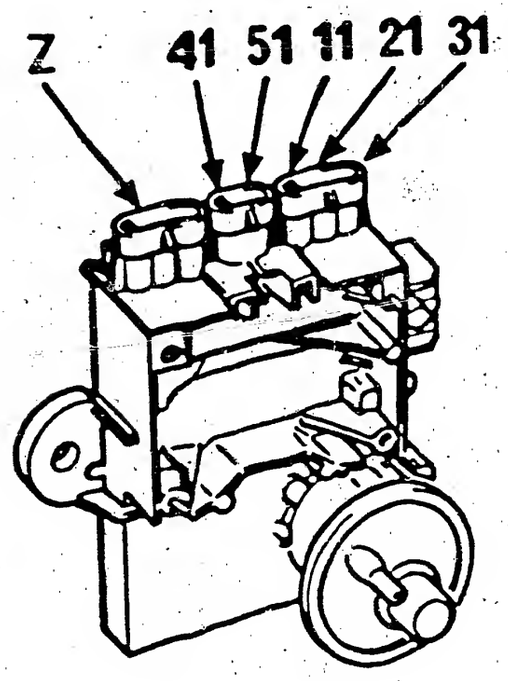
At coolant temperatures in excess of 90° C, the vacuum advance is thus retarded by 4 ± 2°, so as to prevent engine knocking.



WS000146

A = Ignition control unit
B = Relay
C = Coolant sensor
D = Fan
Z = Plug connection

Connection diagram for ignition timing correction by means of coolant-temperature sensor.



WS000195

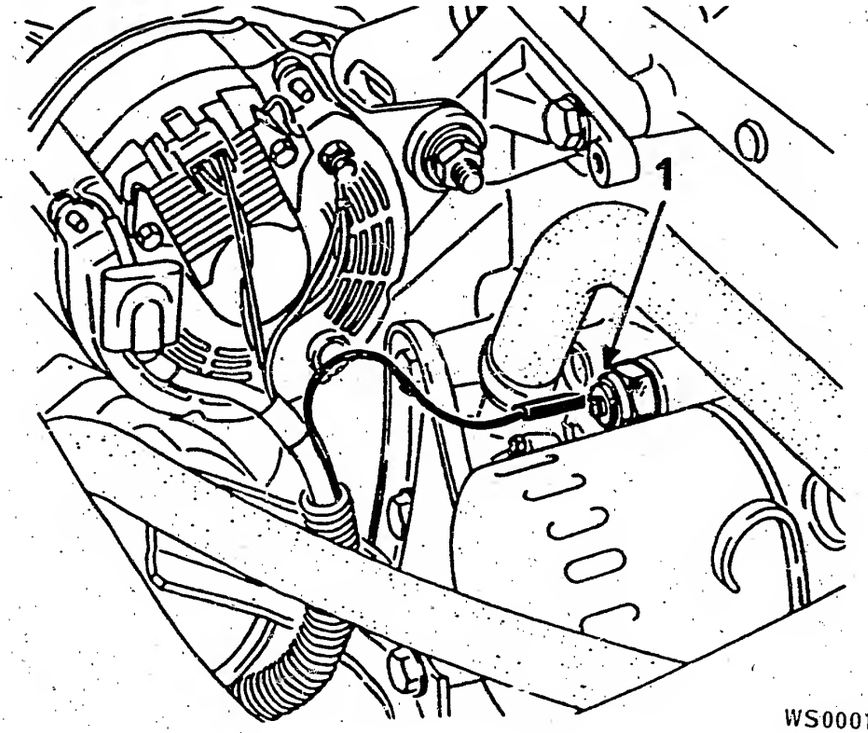
A lead to the oil-temperature sensor is connected to connection B in the socket Z (top picture).

This connection is designed to advance the vacuum timing control by 10 ± 2° at oil temperatures below 15° and above 70° C and in the event of an intake-manifold pressure > 380 mbar.

The vacuum advance is not influenced in the temperature range between 15 and 70° C.

N o t e :

With the engine type F2N 712, one knock sensor is connected in place of the 2 temperature sensors.



WS000147

Position of oil-temperature sensor at engine block (1).

4. Testers

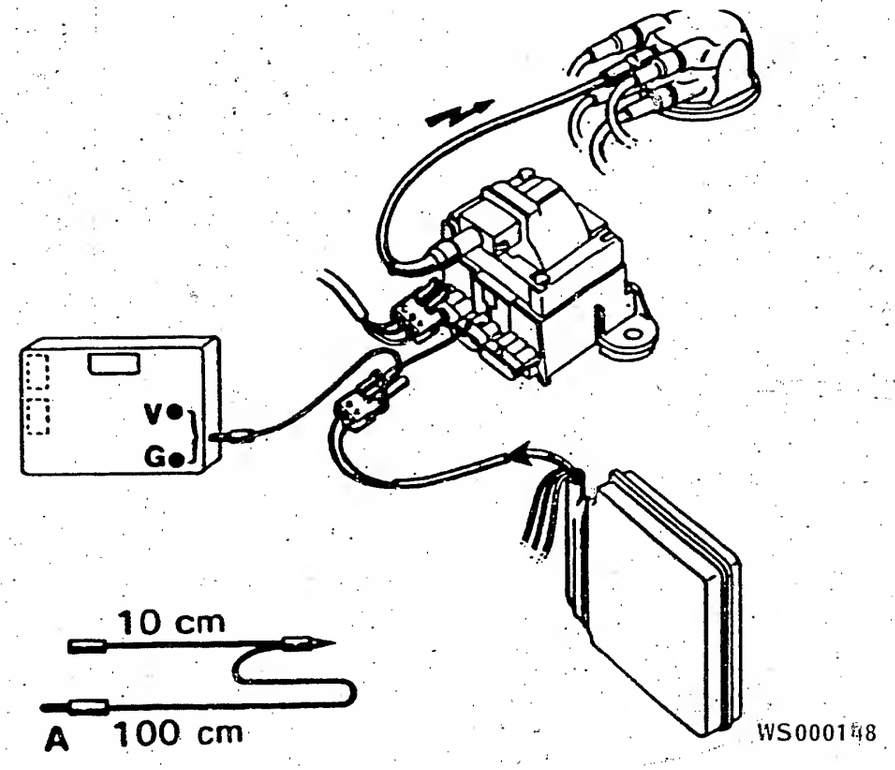
The ignition system can be tested using conventional equipment such as

- voltmeter and ohmmeter
- test lamp and timing light.

The vehicles feature a diagnosis system. This system can however only be used to check the engine speed and the primary circuit.

The diagnosis plug is located together with the ignition module on a retaining plate in the engine compartment. The following measurements can be performed at the smaller of the plugs:

- At plug 2: check on primary circuit B+
- At plug 1: check on engine speed
- At plug 3: serves as vehicle ground.



The ignition system can be tested with the portable test set "XR 25". This can however only be used to measure the ignition pulses.

At the same time, it is advisable to measure the high voltage which should be at least 22 kV. If not, the ignition coil is to be replaced.

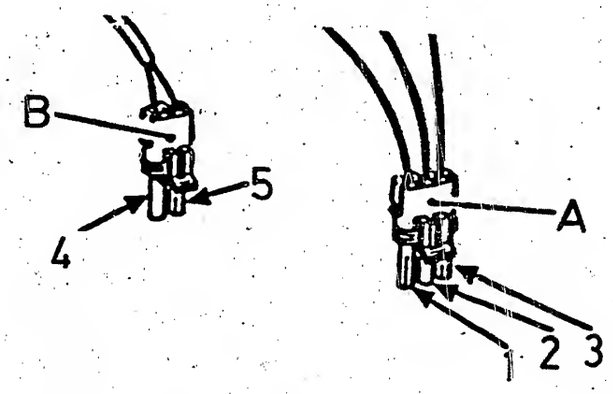
5. Trouble-shooting and measurement procedures

a) If there is no ignition voltage

- First visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- Plugs A and B are to be detached, the pins cleaned if necessary, and the plugs fitted and detached several times.

Measurement conditions	Measurements	Diagnosis
Detach plug A, switch on ignition Actuate starter	Control-unit voltage between +connection and vehicle ground = > 9.5 V	Check battery voltage Check power supply to control unit
	O.K.	
Detach plug A, switch off ignition	Resistance between plug ground and vehicle ground = 0 Ω	Check ground cable of control unit
	O.K.	
Detach plug A, switch off ignition	Voltage at ignition coil = 0 V	Replace control unit
	O.K.	
Connect plug A, switch on ignition	Plug connection and vehicle ground = > 9.5 V	Check plug contacts and connection to ignition coil
	O.K.	

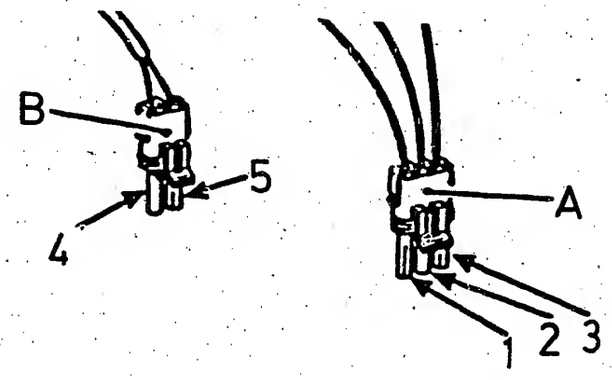


WS000192

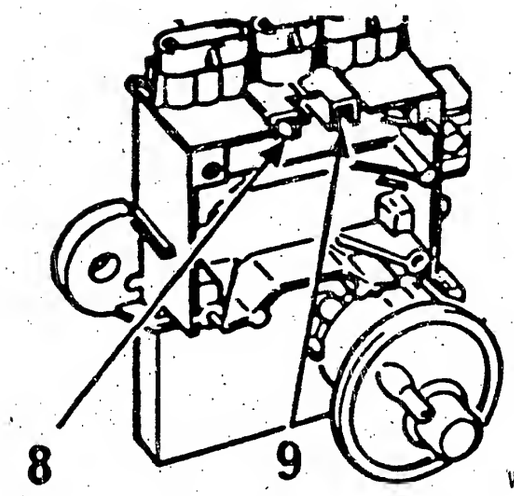
A = Triple connector
B = Pulse-generator plug
1 = Current supply +
2 = Ground
3 = Rev counter

Trouble-shooting and measurement procedures (continued)

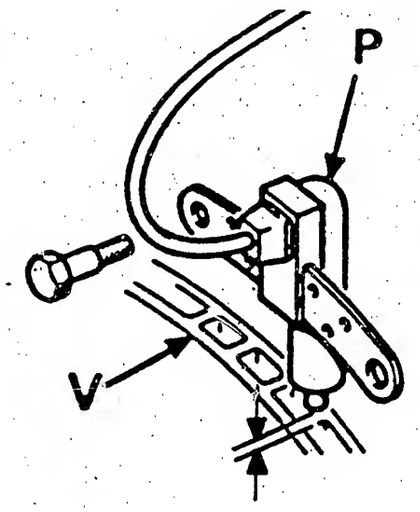
Measurement conditions	Measurements	Diagnosis
Detach plug B, switch off ignition	Pulse-generator resistance = 200 ± 50 Ω	Replace pulse generator
	O.K.	
	Distance between pulse generator and flywheel = 1 mm ± 0.5 (bottom picture)	Replace pulse generator
	O.K.	
Plugs A and B connected, ignition coil disconnected, starter cranking	Indicator lamp between cable 8 and 9 connected, must flicker (center picture)	Replace control unit
	O.K.	
Ignition coil removed	Resistance of secondary winding = 2-12 k Ω	Replace ignition coil
	O.K.	
Ignition coil removed	Resistance of primary winding 0.4-0.7 Ω	Replace ignition coil
Plug A detached	Insulation of rev counter = > 20 k Ω	Replace wiring harness or rev counter
	O.K.	
	No secondary voltage	Replace control unit



WS000192



WS000197



WS000194

b) Starting problems, however trouble-free with engine running

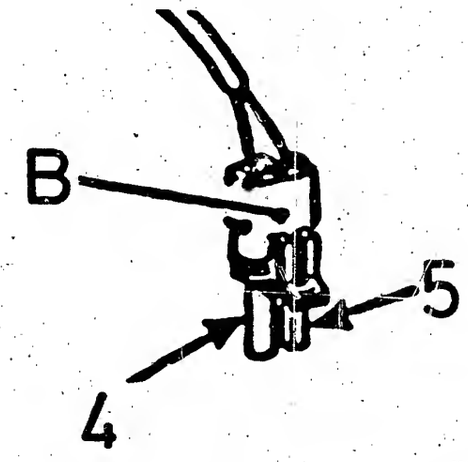
- Visual inspection of spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- H.T. check with spark tester.
  Spark length = at least 2 cm.

Actuate starter	Strong, even spark; if not voltage of control unit = > 9.5 V	Control unit, battery condition or charge
	O.K.	
	Carburetor or fuel injection, compression, ignition timing	
	O.K.	
	Resistance of pulse generator (term. 4 and 5) = 200 ± 50 Ω	If defective, replace
	O.K.	
	Distance between pulse generator and flywheel = 1 ± 0.5	Replace if not correct

c) Check on vacuum unit (carburetor engines only)

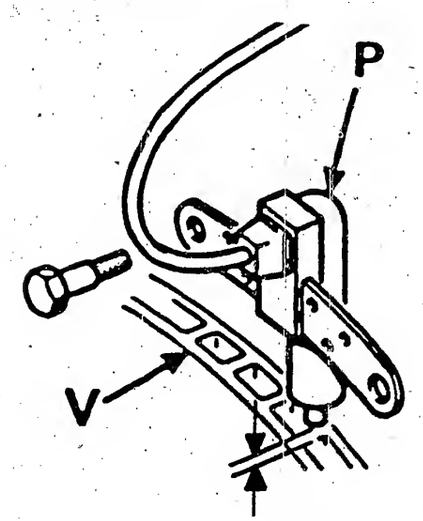
- Stabilize engine speed at 3000 min $^{-1}$.
- Detach vacuum hose at unit
- Engine speed decreases = vacuum unit O.K.
- Engine speed remains stationary = check vacuum hose.
- Vacuum hose O.K. = control unit defective, replace.



WS000196

B = Pulse-generator plug
4 = Pulse generator
5 = Pulse generator

P = Pulse generator
V = Flywheel

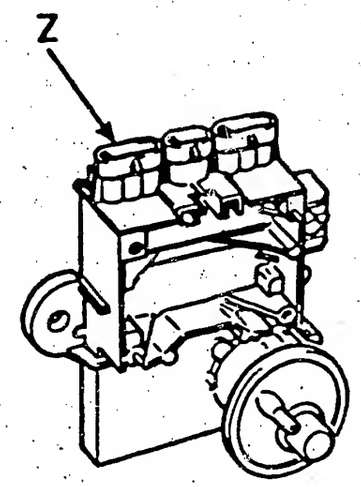


WS000194

Ignition-distributor values (vacuum unit disconnected!)

Advance curve		RE 232	RE 234
Idle speed	750 ± 100	5...9	3...5
Average speed	1550 ± 100	8...12	7...9
High speed	4050 ± 100	26 ..29	24...27

Vacuum check:
Hold engine speed at 4550 ± 100 min^{-1} ,
use hand pump to increase vacuum from
0 to 300 mbar. Ignition timing must change
by more than 8° 15°



WS000200

Note:
Plug (Z) of ignition timing (top picture) must be pulled out during test. Insert again afterwards.

The ignition point cannot be adjusted.

The advance curve number is indicated on the plate on the ignition module.
d) Coolant-temperature sensor

This alters the ignition point by means of signals which it passes to the control unit.

Engine speed between	Temperature	
1200...4700 min^{-1} , vacuum	< 90° C	> 90° C
between 0...270 mbar.		
Vacuum advance =	0°	− 4 ± 2°C

Resistance test at coolant-temperature sensor:

Water temperature °C	Resistance in ohms
115 ± 5	90 ± 10
100 ± 5	140 ± 10
50 ± 5	760 ± 50
20 ± 5	3000 ± 200

With the ignition switched on, a voltage of 4...6 V must be applied to the plug of the coolant-temperature sensor.

e) Oil-temperature sensor

This temperature sensor has a dual function in that it establishes a ground connection at temperatures below 15°C and above 70°C.

Temperature	15° C	15...70° C	70° C
Timing advance between 1200 and 2500 min $^{-1}$ and vacuum 380 mbar	10 ± 2°	0	10 ± 2°

Note:
On certain vehicles, this plug is used for the knock sensor.

f) Vehicles with self-diagnosis

On such vehicles, a malfunction in the coolant-temperature sensor is indicated – in addition to other malfunctions – by means of a code (E8). In order to activate the self-diagnosis, the ignition must be switched on for at least 2 minutes. After switching on the ignition, a fault code (E8 for a fault in the temperature sensor) then appears on the digital instrument panel in place of the speed. In such cases, the sensor and its lead are to be tested. As of model 1987, the self-diagnosis also indicates a fault in the ignition module (AEI) or in the power output stage (MPA) by way of the fault codes E4 and E9. In such cases, the resistance is to be measured at the AEI or the MPA between the connections A and C.

Set value for vehicles up to 1987 = 800 ± 200 Ω
as of 1987 = 1000 ± 500 Ω

6. Spark plugs

Types:	AC C41CLTS; Champion S7YC
Electrode gap	0.75 ... 0.85 mm

This microcard was prepared exclusively for Bosch Service on behalf of ROBERT BOSCH GMBH STUTTGART

J. Pfyl-Ing. HTL
Ingenieurbüro für Auto-Technik

Drawn up on the basis of a publication by the same author which appeared in the "Auto-Technik" magazine published by the AT-Fachschriftenverlag AG, CH-5001 Aarau.

The BOSCH equipment and the test specifications/ settings for BOSCH products and components are always to be taken from the BOSCH microcards. Test specifications and circuit diagrams are contained in the microcards and workshop documentation already introduced into BOSCH after-sales-service workshops.

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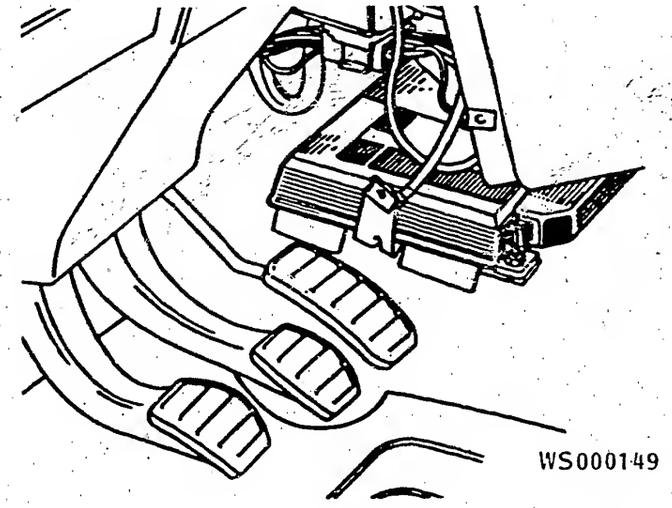
RENAULT 21 (Nevada) 2.0i, 86 kW, engine J7R

21 (Turbo) 2.0i, 129 kW, engine J7R

25 (Espace) 2.0i, 86 kW, engine J7R

25 2.2i, 79/81/91 kW, engine J7T

Espace 2.2i, 79/89 kW, engine J7T/J8S



WS000149

1. Design and function

The Renix ignition system (AEI) is fully electronic. The flywheel is provided with gear teeth (40 teeth). Two additional teeth are twice as wide and offset by 180° with respect to one another. They are used to determine the TDC position, whereas the normal teeth indicate the engine speed to the control unit by way of the pulse generator with permanent magnet and induction coil permanently attached to the housing.

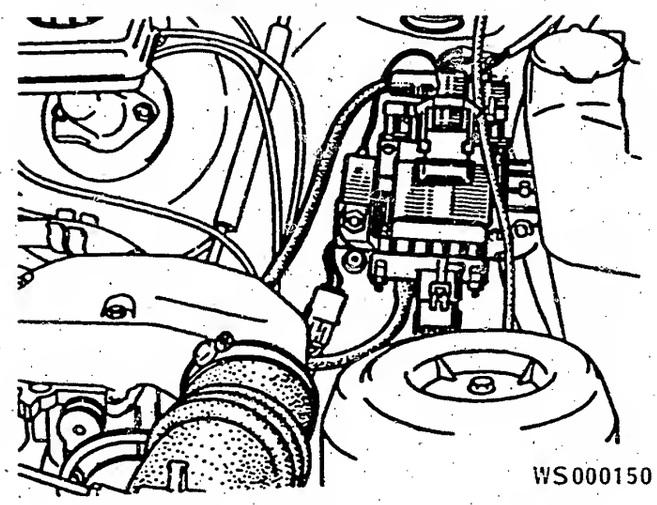
The control unit uses the engine speed and intake-manifold vacuum to calculate the most favorable ignition point and informs the electronic ignition module as to certain corrections and special conditions.

The rev counter is also connected to the ignition module.

The two circuits for triggering the ignition spark and for the ignition timing (map control) are integrated into the injection control unit. This control unit is installed in a closed box in the engine compartment on the R 21 and is located on the other models in the passenger compartment beneath the center console (top picture).

The engine compartment only accommodates the ignition coil with power output stage (MPA) to which the vacuum sensor (intake-manifold pressure) is likewise attached (bottom picture).

US = Vacuum sensor

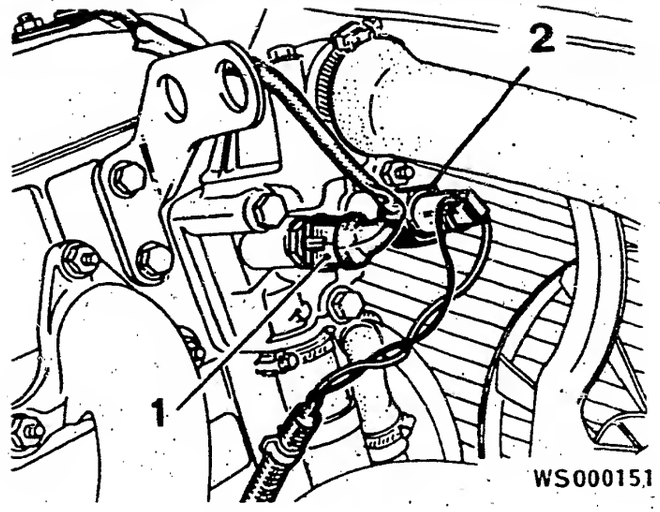


WS000150

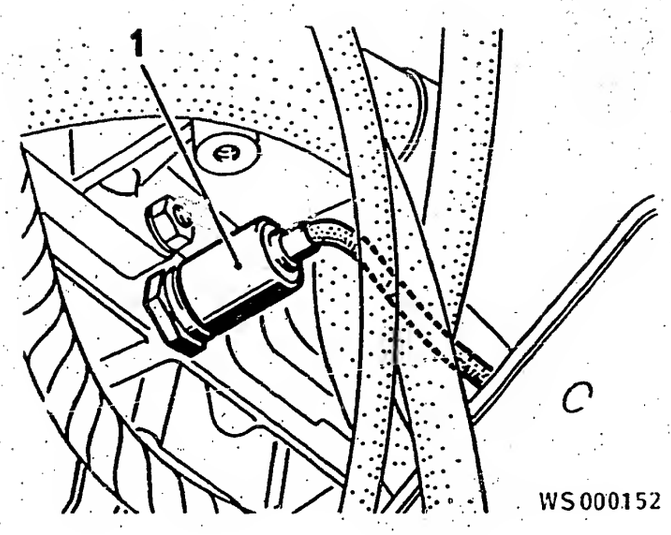
The control unit features two additional internal connections via which correction functions triggered by a coolant-temperature sensor (top picture) and the intake-manifold-pressure sensor are input.

If the coolant temperature is in excess of 90° C, the vacuum advance is thus retarded. A knock sensor (bottom picture) is also provided and this retards the ignition point on a cylinder basis in the event of engine knocking.
The amount may be up to 7° in the non-critical zone or between 1 and 2° in the critical zone.

Testing and trouble-shooting can be performed with the special tester XR 25. This tester can be used to scan the memory integrated into the control unit with the engine stopped or the sensor signals with the engine running.



1 = Coolant-temperature sensor
2 = Temperature-switch for cooling fan



2. Safety instructions

- Never allow high voltage to spark over on to electronic ignition module.
- Never connect primary and secondary connections of ignition coil to ground.
- Never start engine with battery connection detached.
- Never start using fast charger.
- Never disconnect battery with engine running.
- Remove control unit at temperatures in excess of 80°C (stove enamelling).
- Disconnect battery before performing electric welding work.
- Never disconnect or attach plug of control unit with ignition switched on.

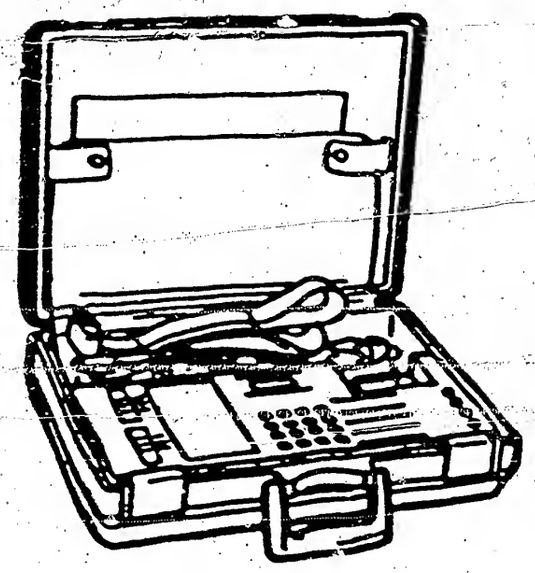
3. Testers

The following can be used for standard measurements:

- Voltmeter and ohmmeter
- Test lamp and timing light.

The vehicles feature a diagnosis system. This system can however only be used to check the engine speed and primary circuit.
The diagnosis plug is located together with the ignition module on a retaining plate in the engine compartment.
The following measurements can be performed at the smaller of the plugs:

- At plug 2: Check on primary circuit B +
- At plug 1: Check on engine speed
- At plug 3: Serves as vehicle ground.



WS000153

Tester XR 25

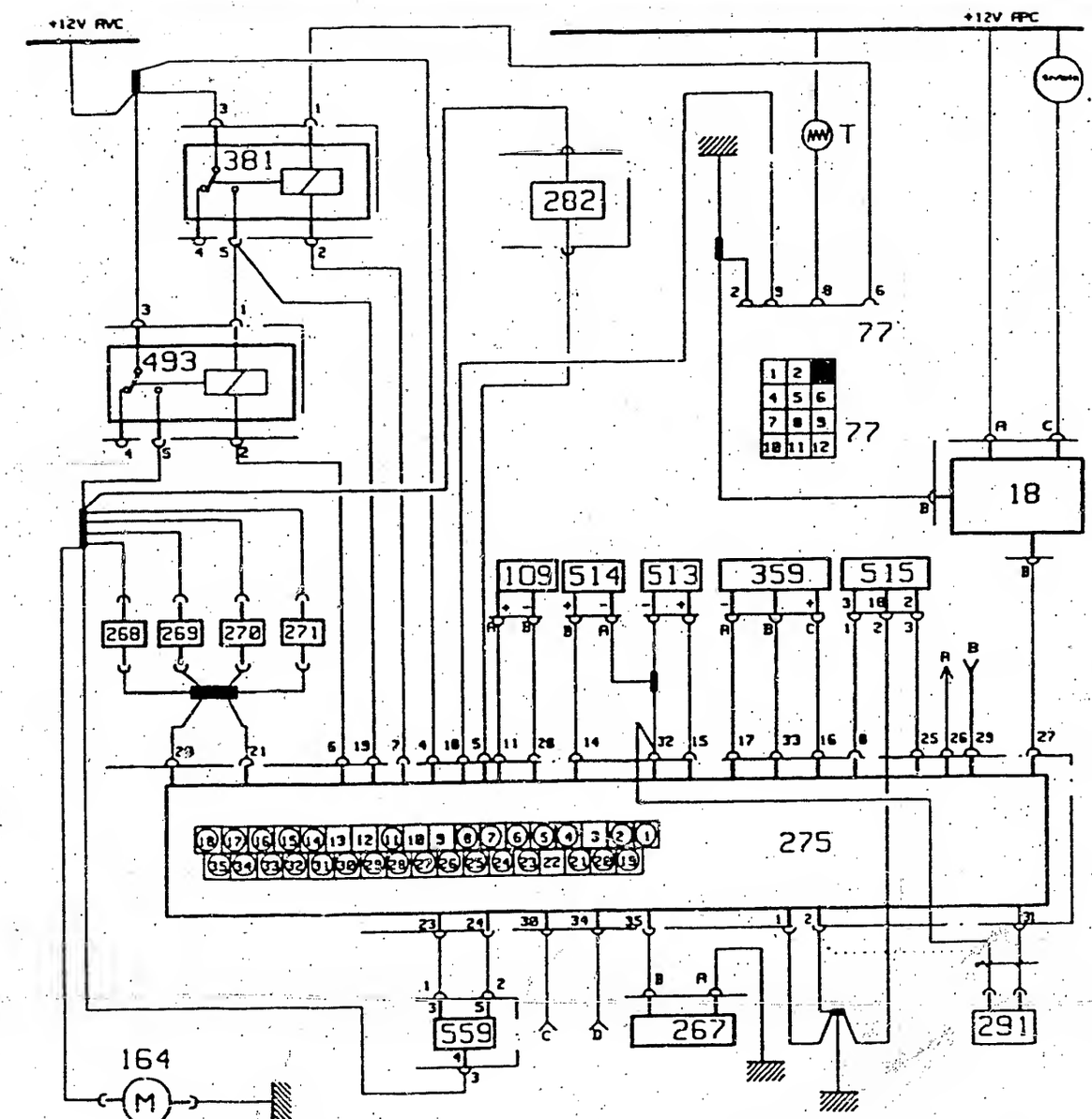
The tester XR 25 can be used to test the control unit, the engine-speed sensor, the TDC pulse generator, the temperature sensor, the knock sensor and the fuel-injection system. It can likewise be used to establish the proper functioning of the corresponding components and to check the signals at cranking speed (see top picture).

For production reasons:
continued on the following coordinate.

4. Fault table

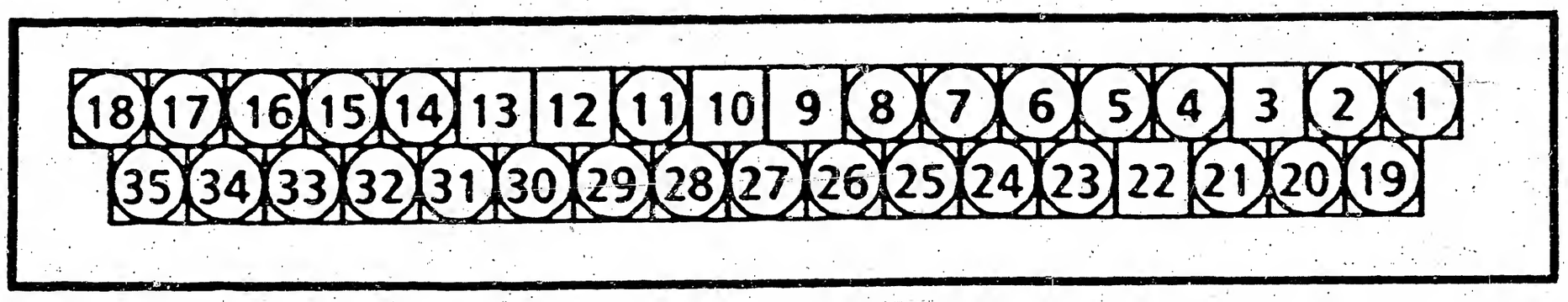
1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Irregular idle	4. Not enough engine power	5. Engine knocking (pinging)	6. Engine missing at all speeds	
X						Engine-speed sensor defective
X						Power stage of ignition module defective
X	X					Intake-manifold-pressure sensor defective
X						Coolant-temperature sensor defective
X				X		Toothing or grooves of sensor system on flywheel defective
			X	X		Problems with H.T. section (distributor, spark plugs, H.T. cable)
					X	Poor ground connection, loose contacts
X	X	X	X		X	Defective control unit

NB: Knocking or pinging noises may also be attributable to an excessively high intake-air temperature or too lean a mixture.



5. Schematic diagram of electrical system of J7R and J7T engines

18 = Ignition module (MPA)
77 = Diagnosis panel (viewed from top)
109 = Pulse generator (flywheel)
164 = Fuel pump
267 = Lambda sensor
268 = Injection valve
269 = Injection valve
270 = Injection valve
271 = Injection valve
275 = Control unit
282 = Solenoid-operated valve of fuel-vapor vent
291 = Knock sensor
359 = Vacuum sensor
381 = Supply relay
513 = Coolant-temperature sensor
514 = Air-temperature sensor
515 = Full-throttle switch (kickdown)
559 = Idle-speed regulation (sol.-op. valve)



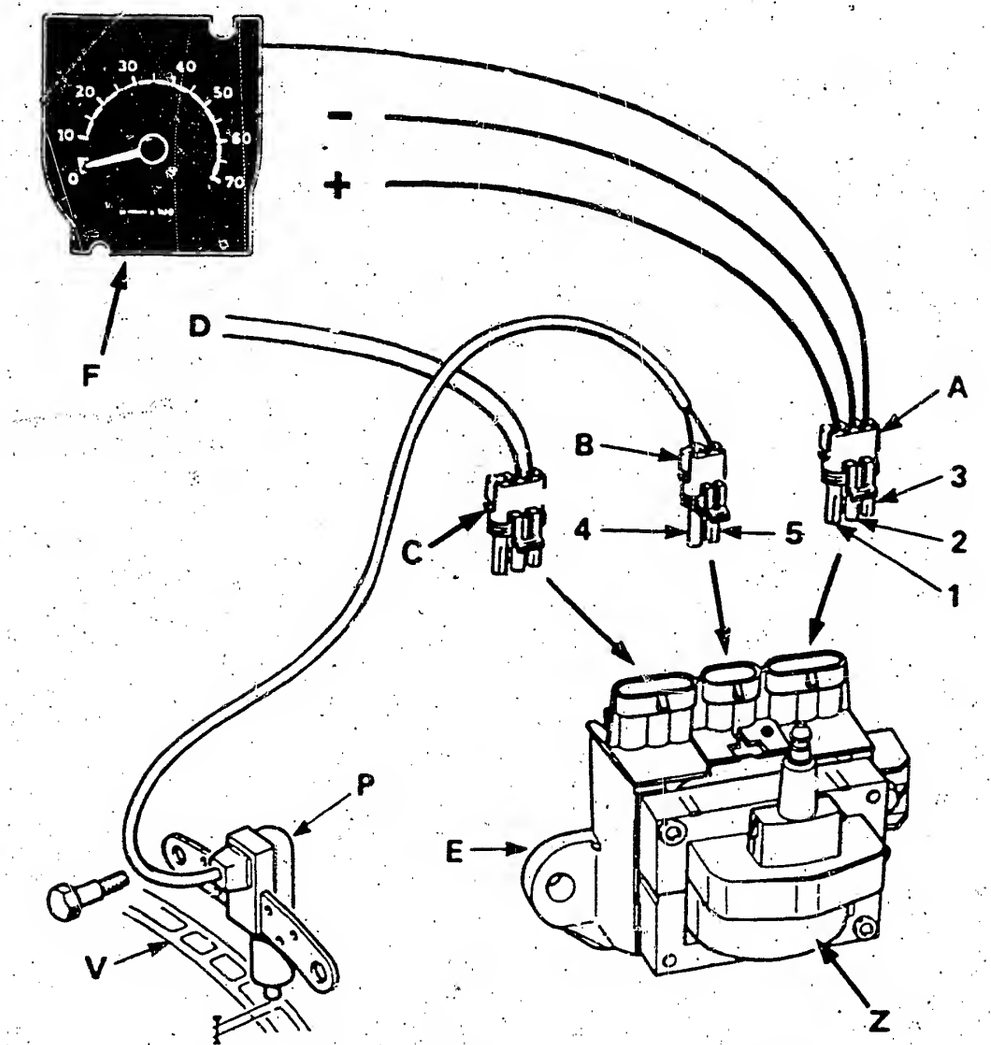
WS000155

Control-unit plug and significance of term. nos.:

1 = Ground
2 = Shielded ground
3 = not used
4 = Current supply (12V)
5 = Solenoid-operated valve of fuel-vapor vent
6 = Current supply via relay 493
7 = Current supply via relay 381
8 = Full-throttle contact
9 = not used
10 = not used
11 = Pulse generator (+)
12 = not used
13 = not used
14 = Air-temperature sensor
15 = Coolant-temperature sensor
16 = Absolute-pressure sensor (+)
17 = Ground of absolute-pressure sensors
18 = Diagnosis plug
19 = Return lead, relay 381
20 = Supply, injection valves
21 = Supply, injection valves
22 = not used
23 = Idle solenoid-operated valve signal
24 = Idle solenoid-operated valve signal
25 = Idle contact
26 = Signal of fuel-delivery measuring instrument
27 = Ignition coil
28 = Pulse generator (-)
29 = Starter signal
30 = A/C signal
31 = Knock sensor (+)
32 = Ground for air and coolant-temperature sensor and knock sensor
33 = Signal of absolute-pressure sensor
4 = Signal of air-temperature sensor
35 = Lambda sensor

D13 — <⟹>

D14 — <⟹>



WS000156

Ignition module with plugs

A = Triple plug with:
    1 = Current supply (+)
    2 = Ground
    3 = Rev counter
B = Twin plug with:
    4 and 5 = Pulse-generator winding
C = Triple plug for temperature sensor and knock sensor

D = to knock sensor and
    temperature sensors
E = Ignition module
F = Rev counter
P = Pulse generator
V = Flywheel
Z = Ignition coil

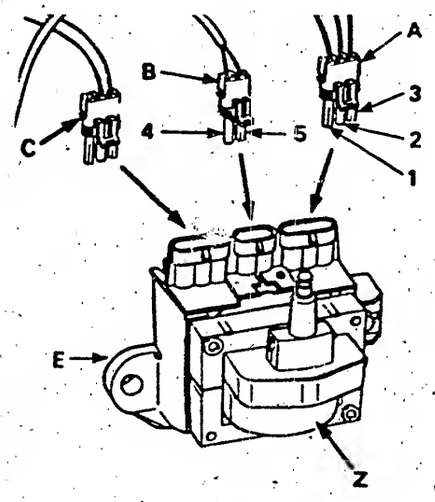
6. Trouble-shooting and measurement procedures

a) If there is no ignition voltage

- First visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- Detach plugs A, B and C at ignition module (top picture), clean pins if necessary and insert and pull out plugs several times.

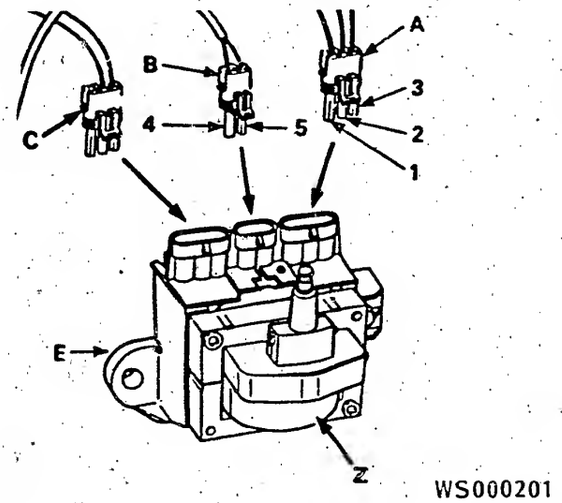
Measurement conditions	Measurements	Diagnosis
Detach plug A (see top picture), switch on ignition Actuate starter	Control-unit voltage between +connection and vehicle ground = > 9.5 V	Check battery voltage Check power supply to control unit
	O.K.	
Detach plug A, switch off ignition	Resistance between plug ground and vehicle ground = 0 Ω	Check ground cable of control unit
	O.K.	
Detach plug A, switch off ignition	Voltage at ignition coil = 0 V	Replace control unit
	O.K.	
Connect plug A, switch on ignition	Plug connection and vehicle ground = > 9.5 V	Check plug contacts and connection to ignition coil
	O.K.	



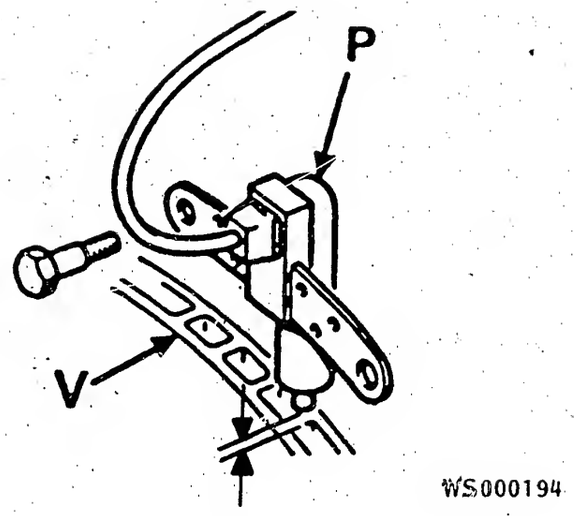
WS000201

Trouble-shooting and measurement procedures (continued)

Measurement conditions	Measurements	Diagnosis
Detach plug B (see top picture), switch off ignition	Pulse-generator resistance = 200 ± 50 Ω	Replace pulse generator
	O.K.	
	Distance between pulse generator and flywheel = 1 mm ± 0.5 (bottom picture)	Replace pulse generator
	O.K.	
Plugs A and B connected, ignition coil disconnected, starter cranking	Indicator lamp between cable 11 and 28 connected, must flicker	Replace control unit
	O.K.	
Ignition coil removed	Resistance of secondary winding = 2-12 k Ω	Replace ignition coil
	O.K.	
Ignition coil removed	Resistance of primary winding 0.4-0.7 Ω	Replace ignition coil
Plug 1 detached	Insulation of rev counter = > 20 k Ω	Replace wiring harness or rev counter
	O.K.	
	No secondary voltage	Replace control unit



WS000201



WS000194

b) Starting problems, however trouble-free with engine running

- Visual inspection of spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- H.T. check with spark tester.
  Spark length = at least 2 cm.

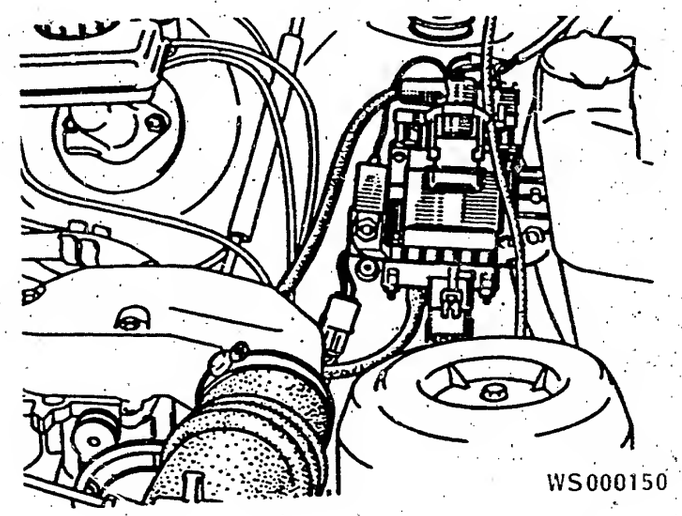
Actuate starter	Strong, even spark; if not voltage of control unit = > 9.5 V	Control unit, battery condition or charge
	O.K.	
	Carburetor or injection, compression, ignition point	
	O.K.	
	Resistance of pulse generator (term. 11 and 28) = 200 ± 50 Ω	Replace if defective
	O.K.	
	Distance between pulse generator and flywheel = 1 ± 0.5	If not correct, replace

c) Check on vacuum sensor

- Stabilize engine speed at 3000 min^{-1} .
- Detach vacuum hose at sensor (see top picture).
- Engine speed decreases = vacuum unit O.K.
- Engine speed remains stationary = check vacuum hose.
- Vacuum hose O.K. = control unit defective, replace.

N o t e :

Plug of ignition timing (knock sensor and coolant-temperature sensor) must be pulled out during testing. Insert again afterwards.



d) Coolant and intake-air temperature sensor

The above sensors change the ignition point by means of signals which they pass to the control unit.

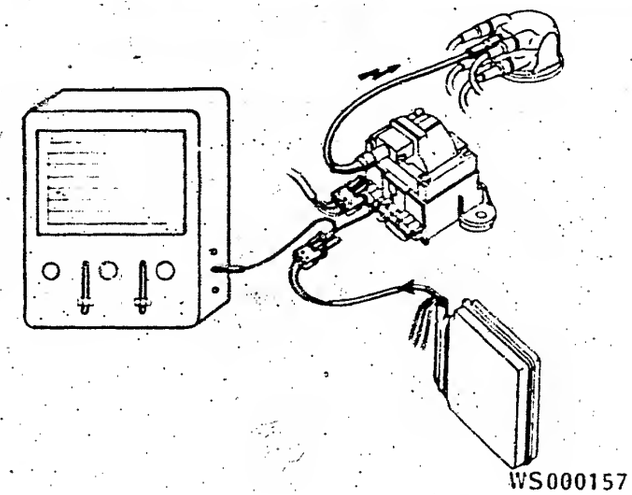
Resistance test

Water			
temp. °C :	20±1	80±1	90±1
Resistance:	283...297	383...397	403...417

Intake-air			
temp. °C :	0±1	20±1	40±1
Resistance:	254...266	283...297	315...329

e) Ignition distributor

This is only designed to distribute the high voltage and cannot be adjusted.



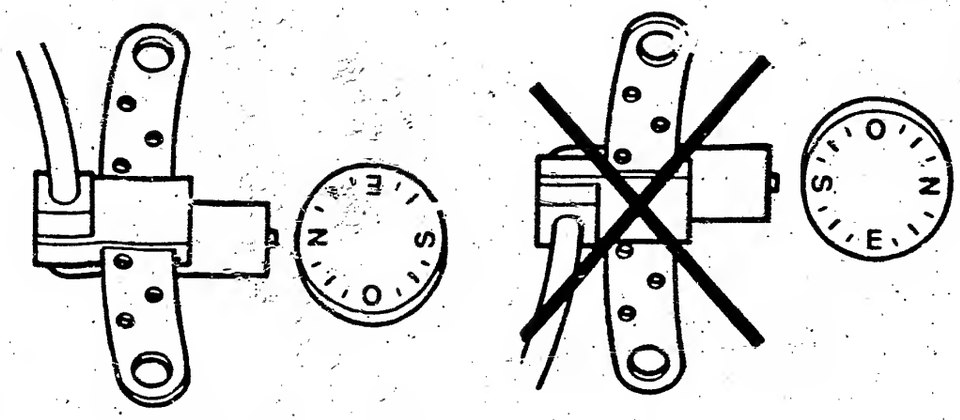
f) Checking with the tester XR 25 is not described here, since instructions are provided with the unit.

The ignition-power module can also be tested with an oscilloscope if this is capable of measuring the time profiles of electrical signals.

The ignition signal must be applied for more than 3 ms at cranking speed and with oscilloscope connected.

If the reading lasts less than 2.9 ms, then the control unit is defective.

If the unit indicates 0 ms, the connection between the ignition-power module and the control unit must be tested (see top picture).



WS000158

Incorrect polarity of pulse generator

Reversing the connections can give the engine-speed and TDC pulse generator incorrect polarity.

To test polarity, use is to be made of a compass which is to be moved towards the disassembled generator as shown in the upper picture.

North is attracted if the generator is working properly.

A defective generator attracts the south pole.

6. Spark plugs

Engine types:	Spark plugs:	Electrode gap (mm)
R21 (* 2.21)	AC C41CLTS Champion S6YC *Champion S7YC	0.75...0.85
R21 (Turbo)	Eyquem 803LJSP	0.75...0.85
R25 (* 2.21)	Champion S6YC *Champion S7YC	0.90

7. Idle speed

The idle speed should be between 775...825 min $^{-1}$ for all engines and should be immediately re-established if a nozzle plug is detached.

8. Vehicles with self-diagnosis

On such vehicles, a fault in the coolant-temperature sensor is indicated – in addition to other faults – by means of a code (E8).

In order to activate the self-diagnosis, the ignition must be switched on for at least 2 minutes.

After switching on the ignition, a fault code (E8 for a fault in the temperature sensor) then appears on the digital instrument panel in place of the speed.

In such cases, the sensor and its lead are to be tested.

As of model 1987, the self-diagnosis likewise indicates a fault in the ignition module (AEI) or in the power output stage (MPA) by means of the fault codes E4 and E9.

In this case, the resistance is to be measured at the AEI or MPA between the connections A and C.

Set value for vehicles

up to 1987 = 800 ± 200 Ω

as of 1987 = 1000 ± 500 Ω

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Ingenieurbüro für Auto-Technik

Drawn up on the basis of a publication by the same author which appeared in the "Auto-Technik" magazine published by the AT-Fachschriftenverlag AG, CH-5001 Aarau.

Bendix and Renix central injection

Installed in 1.4 l engine C3J of Renault Model 5 and in 1,7 l engine F3N of Renault models 5, 9, 11, 19 and 21

This central or single-point injection system, which has been manufactured since 1985/86, was first produced with the name Bendix and installed in B-, C- and F 407 vehicles.

The injection system came to be known as Renix when Bendix Autoelektronik was subsequently taken over by Renault.

This system is installed in some cases in the same engines for the B-, C- and F 407 vehicles and in the subsequent B- and C-408 vehicles as well as in the B37F and C37F versions.

There is little or no difference between the two systems. The main distinguishing feature is that with the Renix injection system the map-type ignition timing and actuation of the H.T. ignition (M.P.A) are integrated into the control unit, whereas this is not the case as yet with the Bendix injection system. This system still features autonomous ignition (A.E.I.).

Rererence is made to instances where there are slight differences as regards design or in terms of checking and adjustment. It can however generally be assumed that both injection systems are identical.

1. Design and function

a) Central injection

The housing of the central injection system is made up of two parts:

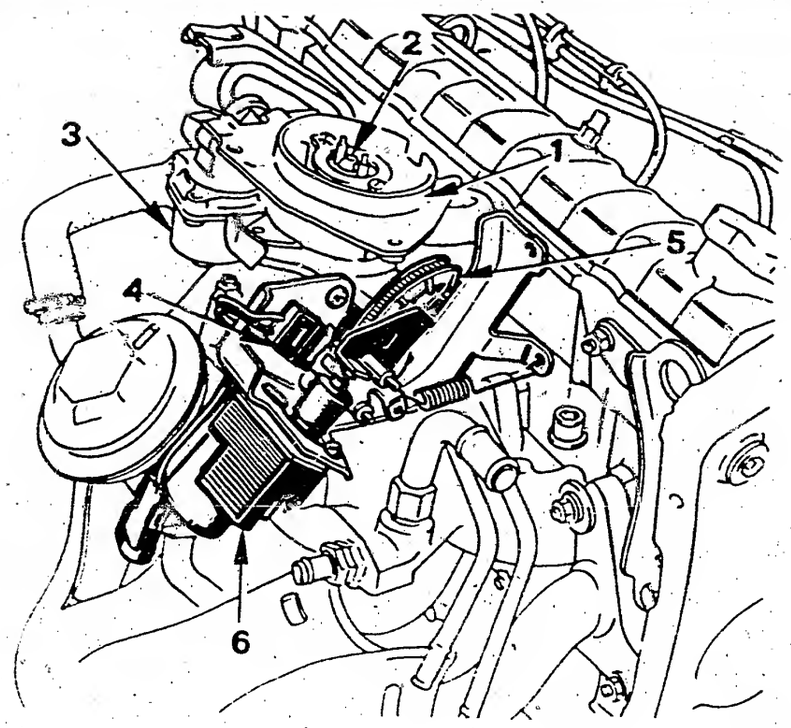
- The throttle-valve assembly with the throttle valve and the full-load contacts as well as the idle servomotor and its microcontact.
- The housing cover to which the air filter is attached and which also accommodates the fuel pressure regulator and the injection valve.

The fuel is conveyed at the necessary pressure and in the required quantity into the injection housing from the tank by means of an electric roller-cell pump.

The fuel mixture is prepared centrally above the throttle valve by means of a single injection valve. The solenoid-operated valve consists of a coil, a valve with ball seat, which is closed by means of a spring, and an atomizer bore. The valve is supplied with fuel by the pressure regulator integrated into the housing cover. The fuel is always at a constant pressure. The solenoid-operated valve, the opening time of which determines the quantity of fuel injected, is actuated by the electronic control unit.

The solenoid-operated valve is excited twice per engine revolution both when starting and during the course of normal engine operation.

The position of the throttle valve is determined by an electric servomotor when idling and during overrun. This motor regulates the opening angle of the throttle valve and represents something of a mobile throttle-valve stop. During overrun, injection is interrupted and the throttle valve fully opened. Precision regulation involving a few degrees of opening is effected when idling.

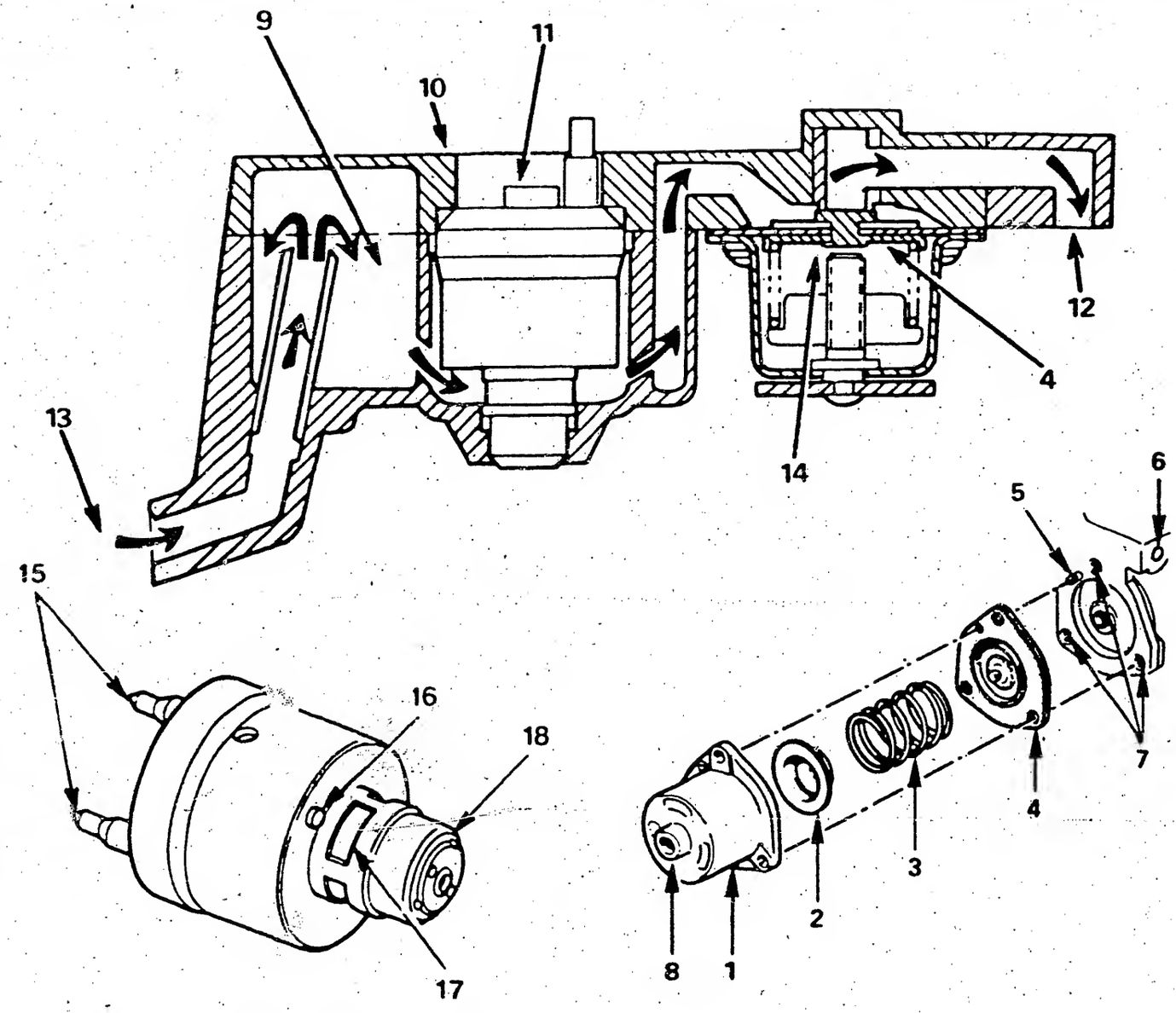


WS000159

1 = Housing cover of injection system
2 = Injection valve
3 = Pressure regulator
4 = Microcontact of throttle-valve switch
5 = Accelerator pedal
6 = Idle servomotor

For production reasons:
continued on the following
coordinate.

Installation position of Bendix/Renix injection system



WS000160

Sectional view of the main components of the injection unit with the housing, pressure regulator and injection valve

1 = Pressure-regulator housing
2 = Spring seat
3 = Spring
4 = Diaphragm
5 = Vent hole
6 = Housing cover
7 = Screw holes
8 = Fuel-pressure regulating screw
9 = Fuel chamber
10 = Cover
11 = Injection valve
12 = Return
13 = Inflow
14 = Chamber
15 = Connections
16 = Guide pin
17 = Fuel inlet
18 = Sealing seat

b) Electronic control unit

Depending on vehicle type, this is installed in the cockpit beneath the glove compartment (top picture) or in the engine compartment at the left-hand wheel house.

The installation location for the electronic control unit is located on the left beneath the glove compartment in the B-, C- and F-407 vehicles; on the other vehicles it is to be found on the right in the engine compartment.

In the case of the Bendix injection system the control unit features two plugs with 24 and 10 contacts respectively. The Renix control unit has a single 35-pole plug.

The following components and sensors provide the control unit with the signals it requires to prepare control pulses:

- Lambda or oxygen sensor
- Coolant temperature regulator
- Intake-air temperature sensor (Renix injection system only)
- Absolute-pressure sensor (intake-manifold-pressure sensor)
- Throttle-valve position sensor
- Crankshaft position sensor (engine-speed sensor)

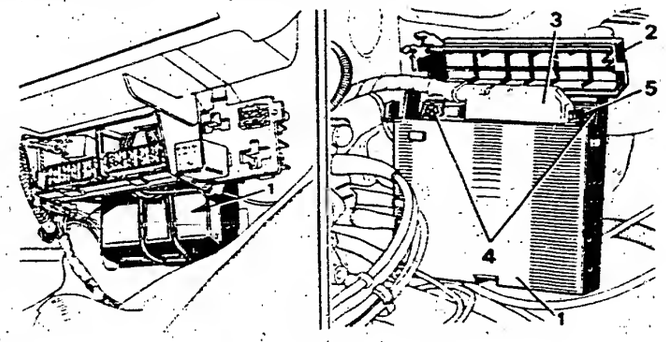
The control unit also checks the following:

- the fuel pump
- the idle servomotor
- the EGR system (where provided)
- and ignition timing by the knock controller (Renix system only)

The Bendix system is supplied with power by three relays located beneath the glove compartment. The picture above shows how they work.

The Renix injection system features two relays beneath the coolant expansion tank in the engine compartment (bottom picture).

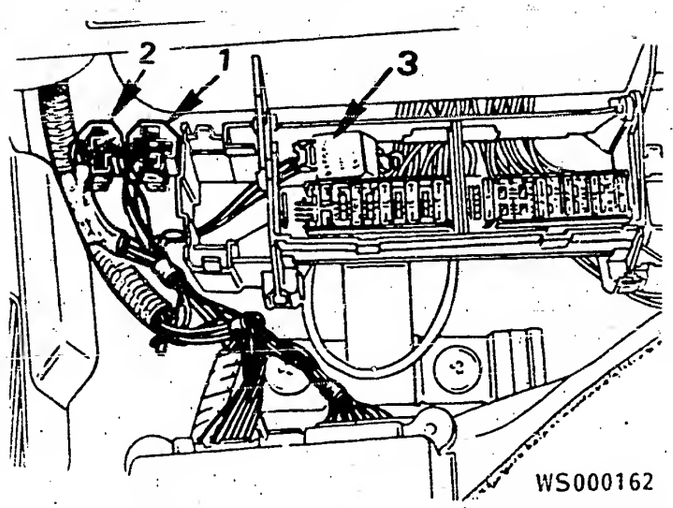
One relay supplies or blocks the control unit, whereas the other performs the same functions for the fuel pump.



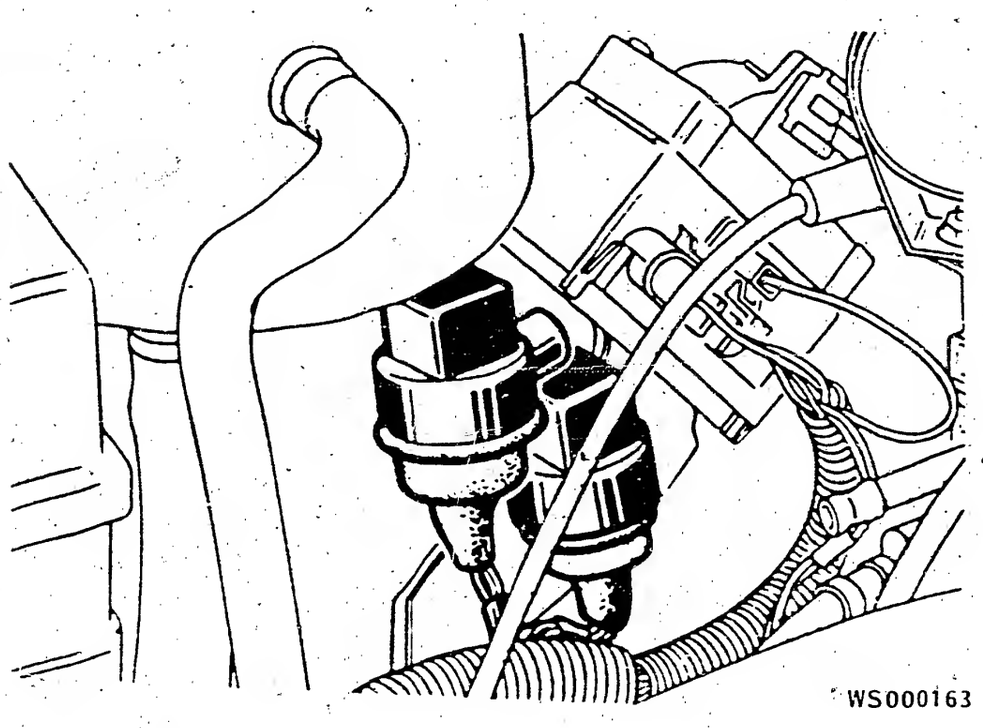
WS000161

1 = Electronic control unit
2 = Cover
3 = Multiple plug
4 = Fastening screws
5 = Safety guide

1 = Control-unit power supply
2 = Fuel-pump relay
3 = Ballast relay



WS000162



Position of supply relays on Renix system

The fuel pump must operate for one second if the ignition is switched on with the engine stopped.
On starting the engine, the starter relay of the Bendix system sends a signal to the control unit to ensure that the control unit provides mixture enrichment for the starting process.

In the event of a cold start, the coolant temperature sensor or intake-air temperature sensor (Renix injection system) likewise contributes to additional mixture enrichment.
The timing maps and the cylinder-selective knock control are also integrated into the control unit.

Furthermore, the system features a diagnosis plug with which faults can be determined using a special tester (XR 25).

2. Tests and adjustments

a) Safety precautions and testers

- Never detach electrical connections without previously switching off the ignition.
- When performing electric welding work, disconnect control unit and remove in the case of temperatures in excess of 80° (stove-enamelling booths).
- Disconnect battery for recharging purposes.
- Before opening fuel system, always pull out 6-pole plug at ignition module.
- Always pull out plug of control unit before testing sensors or cable connections.
- The control unit cannot be tested on its own.
- When performing tests with voltmeter and ohmmeter or indicator lamp, only make use of high-impedance devices and proceed with caution, so as to prevent short-circuits and to make sure incorrect terminals are not connected together.
- A pressure gauge is also required in addition to voltmeter, ohmmeter and indicator lamp.

A special portable test set (XR 25), which is connected to the diagnosis plug, is available for comprehensive system testing and diagnosis.

If such special equipment is not available, faults can be localized and eliminated on the basis of the fault table (see Coordinates B01 ff).

b) Fuel pressure and pump delivery

The configuration is illustrated in the top picture.

3 = Roller-cell pump
4 = Fuel filter

Fuel delivery is effected by means of an electric roller-cell pump with a downstream fuel filter. This filter is to be replaced every 20,000 km.

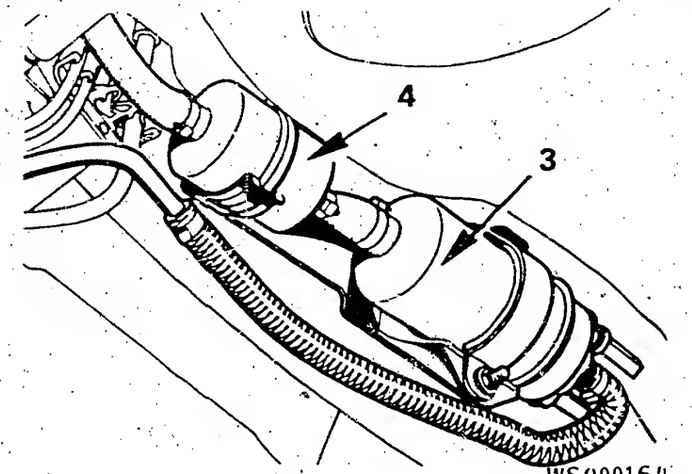
If a pressure gauge is inserted in the supply line directly at the injection housing, a pressure reading of 1 ± 0.05 bar must be obtained with the vehicle types B-, C- and F-407 with Bendix and Renix system. 1.2 ± 0.05 bar must be measured in the case of types B- and C-408 as well as L42F, B37F and C37F with Renix systems.

Center picture:

Measurement of fuel pressure with pressure gauge installed in supply line directly upstream of pressure regulator.

Bottom picture:

The fuel pressure can be adjusted at the location marked with an arrow after removing a plug.



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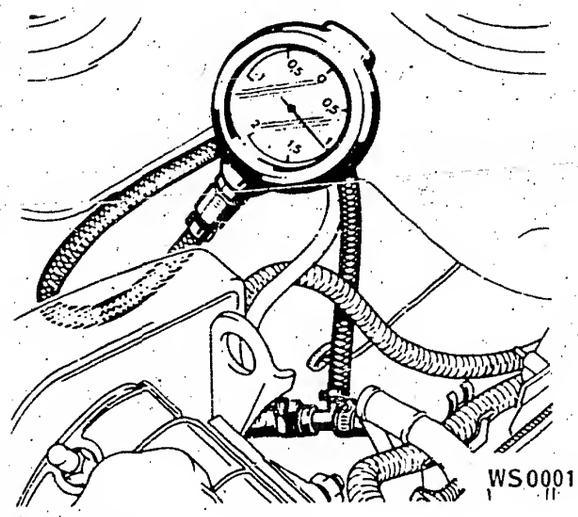
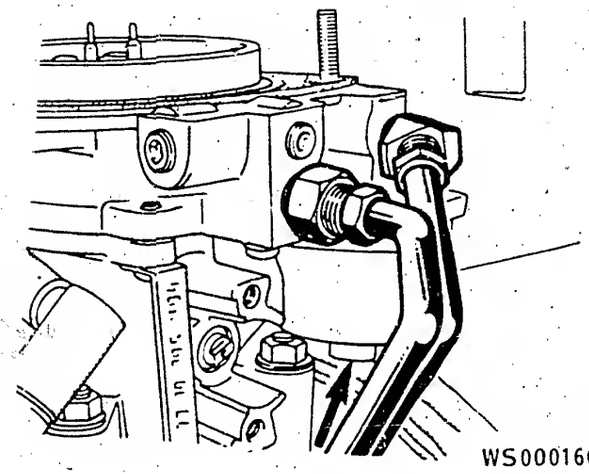

WS000165


WS000166

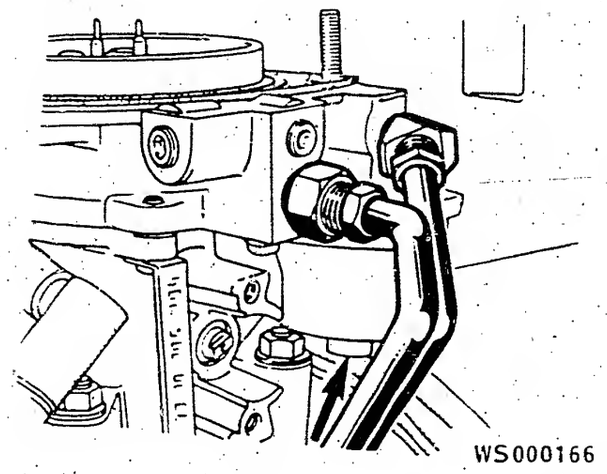
If the return line to the tank is completely interrupted for several seconds, the pressure must increase to 5 bar. In the event of minor deviations, the pressure can be adjusted by means of the screw indicated in the top picture.

To test the delivery, the return line is to be detached and held over a graduate (capacity min. 1.5...2 l). Connections 3 and 5 at the plug of the pump relay are to be connected to one another with the control unit detached. Delivery in 30 seconds greater than 1 l. Inadequate peformance may be the result of a clogged filter, inadequate supply voltage or wear.

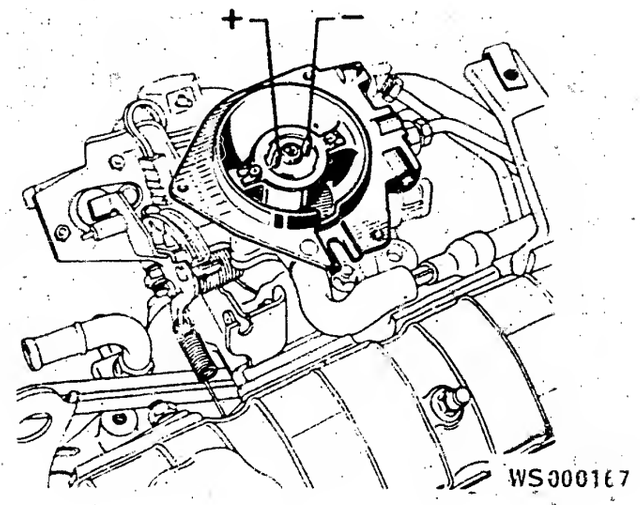
c) Injection valve

The two connections 3 and 5 at the fuel-pump relay are to be connected to one another after removing the air filter and detaching the plugs at the control unit and ignition module. Finely atomized fuel must be injected into the housing if a voltage of 12 V is then applied to the terminals of the injection valve (bottom picture).

The injection valve must not drip when no voltage is being applied. The resistance of the solenoid should be 2.5 $\pm$ 1 Ω. On removal or installation, the seal rings are always to be replaced and attention is to be paid to the guide pin at the housing.



Testing injection valve by applying a voltage of 12 V



d) Coolant and mixture temperature sensor

These are to be removed for checking and tested as to their temperature function and resistance.

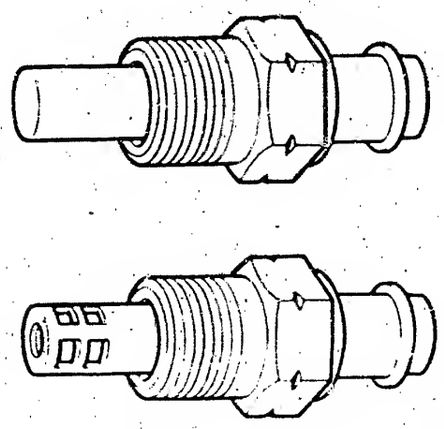
Set values:

Bendix B-, C-, F-407

Temperature	k Ω
0°	31...35
25°	9.7...10.3
50°	3.45...3.75
80°	1.16...1.35
100°	0.63...0.74

Renix L42F, B-, C37F, B-, C-408

Temperature	k Ω
4°	7.5
20°	3.4
70°	0.45
100°	0.185



WS000168

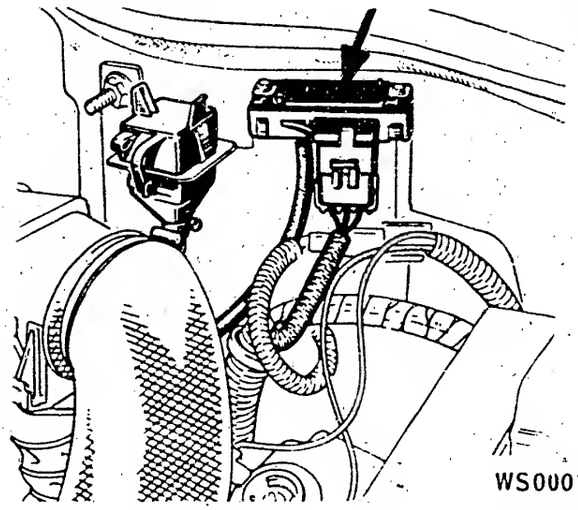
Coolant (top) and air-temperature sensor

e) Absolute-pressure sensor

The connecting hose and the connections are to be checked as to their condition and freedom from leaks (do not apply excessive force to pressure sensor). Repair if applicable.

Proper connection between terminal A of the sensor (bottom picture) and terminal 13 (Bendix) or 17 (Renix) is to be tested using an ohmmeter. Proper grounding of the connections 1, 2, 10 and 12 is additionally to be checked with the Renix system.

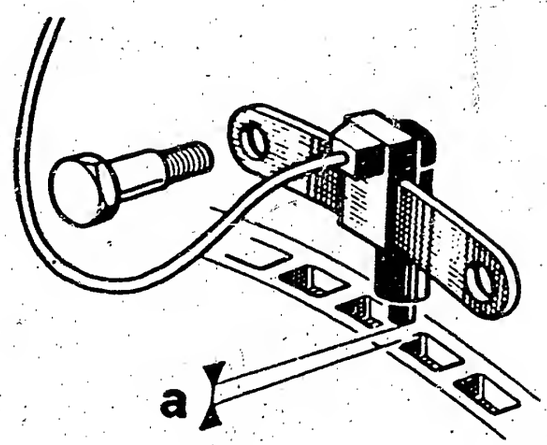
Position of absolute-pressure gauge (arrow) at engine bulkhead



WS000169

f) Engine-speed sensor

The engine-speed and TDC sensor is primarily responsible for ignition. It does however also pass the engine speed to the control unit as an input variable. The resistance of the pulse generator should be 200 Ω . The distance between the flywheel and the sensor should be 1 ± 0.5 mm (see top picture).



WS000186

g) Throttle-valve position sensor

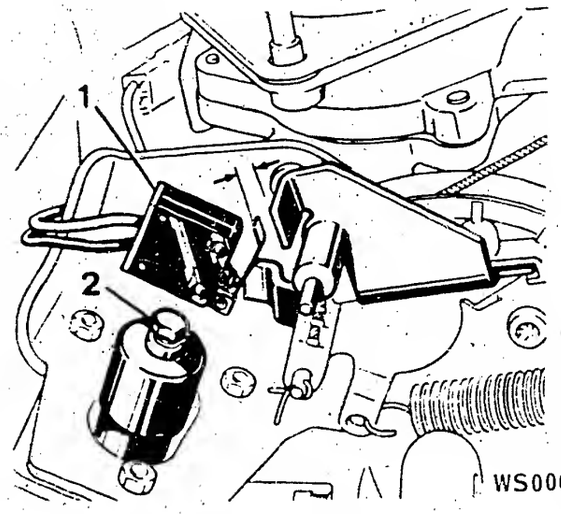
The throttle-valve position sensor (full-throttle switch) (1) and the throttle-valve servomotor with the adjusting screw (2) are mounted on the same retaining plate. The measurement arrows indicate the check distance of 6 ± 1 mm (center picture).

The switch (see center picture) attached to the retaining plate of the idle servomotor indicates the position of the throttle valve to the control unit in the form of a voltage signal. The cable connector is to be attached for checking.

Proper functioning of the switch is then to be tested by actuating the throttle valve several times. When the switch enters the full-throttle range, a pronounced clicking noise must be heard. Otherwise, the switch is to be replaced.

The resistance of the switch when the throttle valve is closed must be infinity ohms and approx. 0.15 Ω at full throttle.

The full-throttle range with the above-mentioned resistance of approx. 0.15 Ω must be produced given a distance of 6 ± 1 mm between the throttle-plate-lever stop and the lever itself. This can be tested for example using a 6 mm drill (bottom picture).



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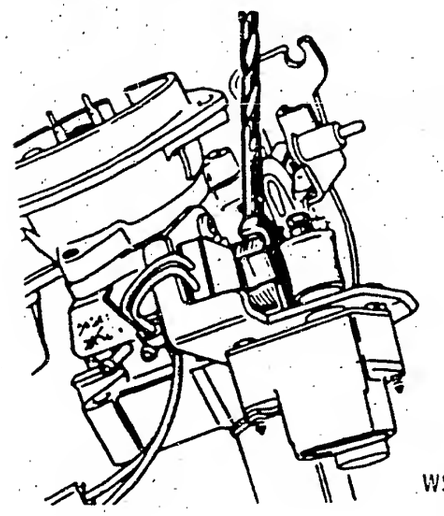
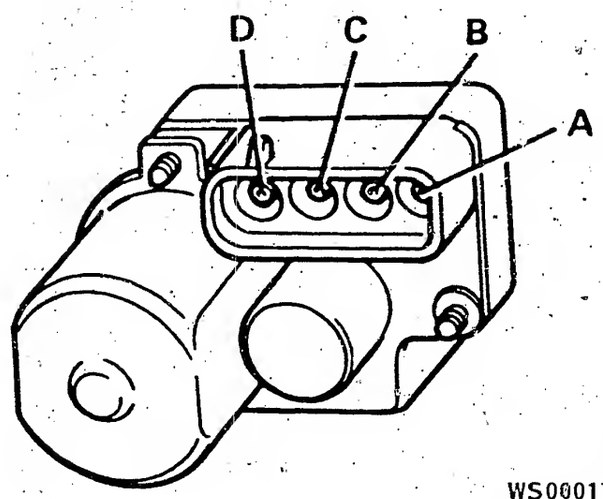

WS000198

h) Idle servomotor

The servomotor can be tested in two ways. After detaching the plug, an ohmmeter is connected to terminals A and B (top picture). With armature extended (throttle valve in full-throttle position) it must be possible to measure a resistance of 5 k Ω ; with the armature retracted, the measured resistance must be 0.15 Ω .
The servomotor is to be removed for the purposes of the other test method. A voltage of 12 V (+) is then to be applied to terminal D and ground (–) to terminal C. The armature of the servomotor must be extended in this process. The armature must be retracted if the polarity at the terminals is changed (+ at C, – at D).
Following replacement of a defective servomotor, the new motor must be set as follows:

- The engine is to be brought up to operating temperature. The ignition must be in perfect working order. A rev counter is then to be fitted.
- The armature of the servomotor must be fully extended in the case of a warm or stopped engine.
- With the servomotor fully extended, detach its plug and then start the engine.
- For both the Bendix and the Renix injection system, the engine must attain a speed of 3,000 ± 100 min^{-1} . If the speed is not correct, the prescribed speed is to be set by turning the hexagon stop screw (Item 1 in bottom picture).
- The armature of the servomotor is to be completely retracted and held in this position, whilst the throttle valve is opened with the other hand.
- The armature of the idle servomotor must not come into contact with the throttle-valve plate lever when this assumes the idle position. If it does, the accelerator linkage and its setting are to be checked.
- The plug of the idle servomotor is to be reconnected and the ignition switched on and then off again for 10 s. In this process, the armature of the servomotor must again be fully extended.
- After performing repairs, the engine speed is to be checked again. It must re-attain 3,000 ± 100 min^{-1} for a brief period and then slowly decrease to the idle speed of 800 ± 50 min^{-1} . If the engine is properly warm (following 2x switch-on of fan), the difference between the min. idle speed and the max. idle speed must not exceed 150 min^{-1} .
- If this result is not obtained, the following items are to be checked: ignition – lambda sensor – exhaust gas recirculation – idle or full-load contact – coolant or mixture temperature sensor – function of idle servomotor.



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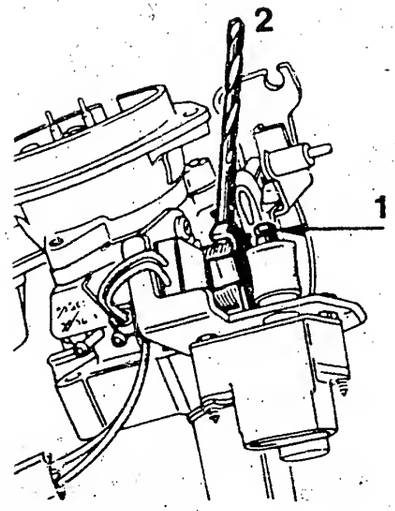

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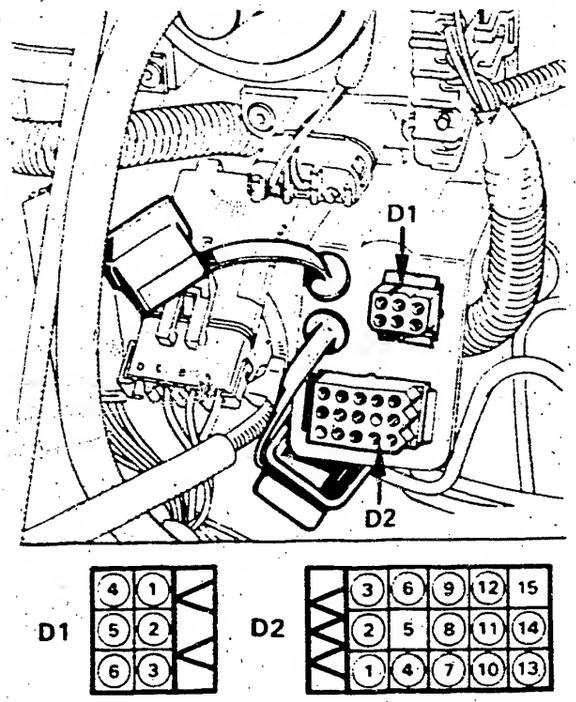
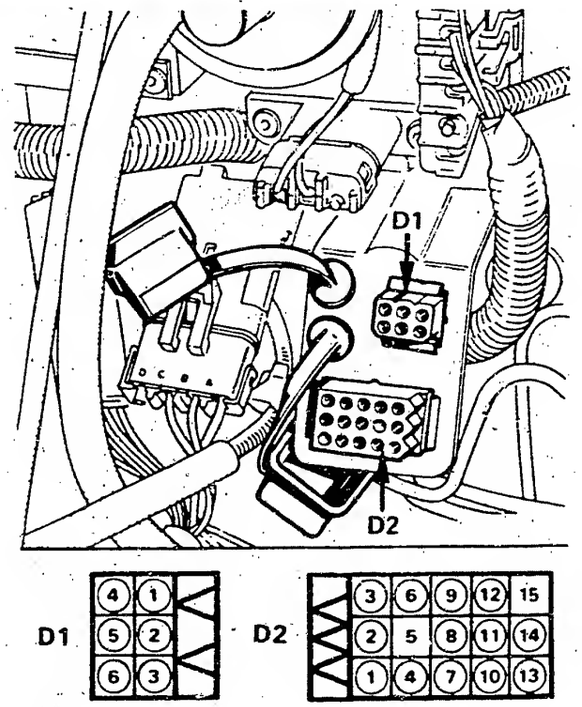


WS000174

Diagnosis plug D1 on Bendix injection system

1 = Engine speed
2 = 12V after contact
3 = Ground
4 = Starter relay
5 = 12V before contact
6 = Fuel pump



WS000174

Diagnosis plug D2 on Bendix injection system

1 – 3 = Not used
4 = Current supply relay
5 = Not used
6 = Full-throttle switch
7 = Return line; air, water and pressure sensor
8 = Information, air-temperature sensor
9 = Exhaust gas recirculation valve (EGR)
10 = Not used
11 = Information, idle servomotor term. D
12 = Information, coolant-temperature sensor
13 = Information, coolant-temperature sensor term. B
14 = Information, coolant-temperature sensor term. C
15 = Not used

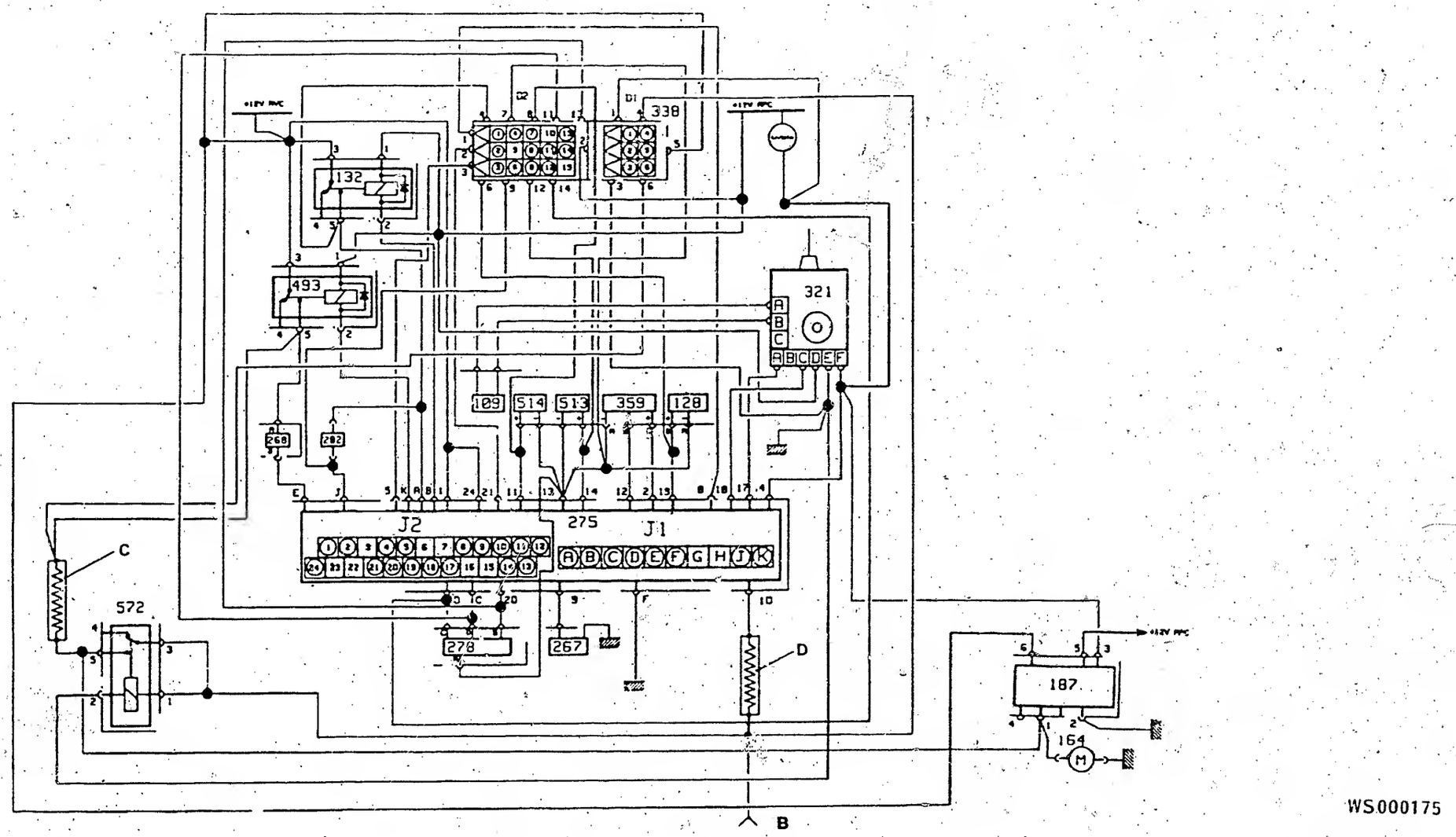
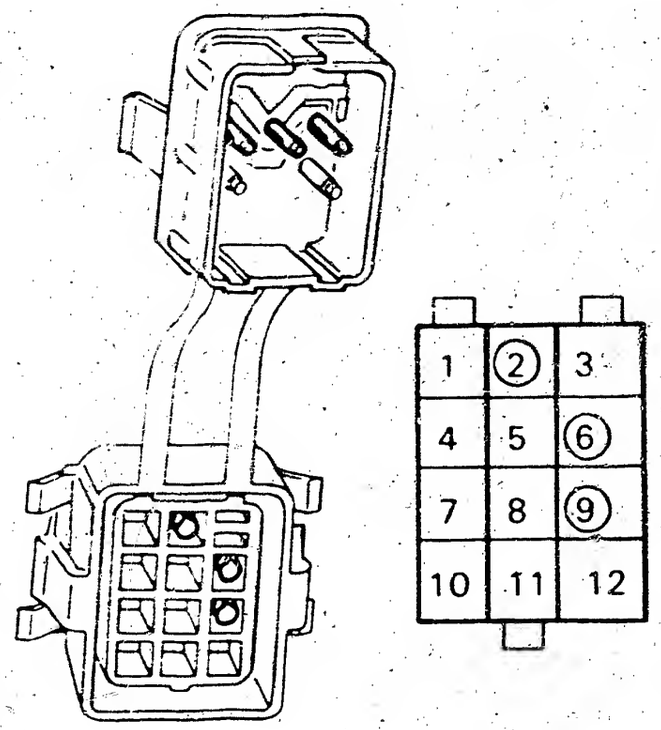


Diagram of Bendix injection system

109 = Engine-speed sensor
128 = Full-throttle switch
132 = Supply relay
164 = Fuel pump
187 = Speedometer relay
267 = Lambda sensor
268 = Injection valve
275 = Control unit
278 = Idle servomotor
282 = EGR valve
321 = Ignition module
338 = Diagnosis plug
359 = Absolute-pressure sensor
493 = Fuel-pump relay
513 = Coolant-temperature sensor
514 = Air-temperature sensor
572 = Ballast relay (fuel pump)
B = Information, starter
C = Ballast resistor
D = Additional resistor



WS000176

Diagnosis plug of Renix injection system

2 = Ground
3 = Fault recognition
6 = + 12 V after contact
9 = Information, injection diagnosis

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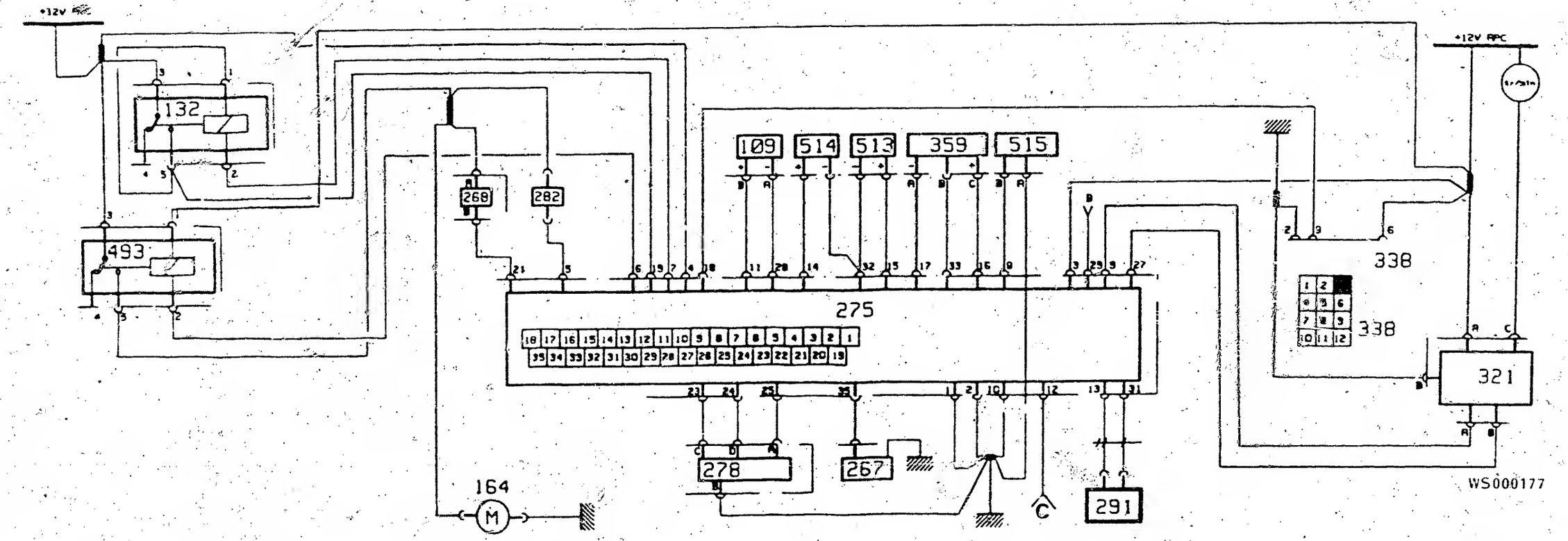

Diagram of Renix injection system

109 = Engine-speed sensor
132 = Supply relay
164 = Fuel pump
267 = Lambda sensor
268 = Injection valve
275 = Control unit
278 = Idle servomotor
282 = EGR valve
291 = Knock sensor
321 = Ignition module
338 = Diagnosis plug
359 = Absolute-pressure sensor
493 = Fuel-pump relay
513 = Coolant-temperature sensor
514 = Air-temperature sensor
515 = Full-load switch
B = Information, starter
tr/min = Rev counter
+ 12 V AVC = before contact (term. 30)
+ 12 V APC = after contact (term. 15)

5. Fault table "Bendix"

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

1	2	3	4	5	6	7	8	9	10	11	12	Cause	Remedy – check
X	X											Relay defective, switching duration 1 s Fuel pump won't run	Test power supply with voltage being applied Check fuel pressure. Is voltage provided at relay and fuel pump? If yes, replace fuel pump
	X	X		X					X			Idle switch incorrectly set or defective	Check setting of throttle-valve switch and switching function, and replace if necessary
X		X	X			X			X			Leak in air-injection system	Check for leak in intake manifold and all parts attached to it as well as for leak in hose connections
X		X		X	X	X						Injection valve defective	Check injection process at valve. Disconnect current connection: Engine must cut out
X		X	X		X		X					Fuel pressure too low or no fuel pressure. Fuel filter/ prefilter contaminated	Check pressure, filter, fuel line, pressure regulator and fuel pump; replace contaminated filter
				X		X						Fuel pressure too high	Is connecting hose connected up between pressure regulator and intake manifold? Fuel return hose clogged or pinched off. Pressure regulator defective

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table "Bendix" (continued)

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
X								X	X			Idle-speed control motor not functioning	Check function; replace if motor defective
	X							X	X			Malfunction in idle-speed control-motor power supply	Check circuit and conformity of control unit; replace if defective or in the event of non-conformity
		X			X				X			EGR valve defective	Check for leaks and check calibration of opening; replace if defective
			X		X							Pulse segment at flywheel defective	Check segments on flywheel for uniformity and conformity
X	X											Sensor for intake-manifold pressure defective	Check connecting hose to intake manifold. Electrically check sensor (+ 5 V)
X												Pulse generator for engine speed defective	Check resistance and spacing
X	X					X						Ignition-power module defective	Check power supply of module and resistance of coil
	X							X	X	X		Sensor for intake-air temperature defective	Check resistance and circuit
X					X				X	X		Sensor for coolant temperature	Measure resistance and circuit
		X	X					X	X			Idle-speed regulation system or CO setting defective	Check idle-speed regulation system and correct CO setting if necessary

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table "Bendix" (continued)

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

1	2	3	4	5	6	7	8	9	10	11	12	Cause	Remedy – check
X	X			X	X							Lambda sensor not functioning	Check idle-speed regulation system and replace lambda sensor if necessary
X												Throttle valve won't close	Free throttle valve; adjust linkage and then set throttle valve
				X								Throttle valve doesn't open completely	Adjust accelerator pedal
			X									Poor main/ground connection, plug contact defective	Check connections
X	X	X	X	X	X	X	X	X	X	X	X	Open-circuit in wiring harnesses and cable connections	Make proper connections
X	X	X	X	X	X	X				X	X	Electronic control unit defective	Check entire system before replacing control unit
X					X	X	X	X	X	X	X	Mixture composition not adapted to engine temperature	Check conformity of sensors for coolant and intake-air temperature

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

4. Fault table "Renix"

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
X	X											Relay defective, switching duration 3 s	Test power supply with voltage being applied
X	X						X					Fuel pump won't run	Check fuel pressure. Is voltage provided at relay and fuel pump? If yes, replace fuel pump
	X	X		X				X				Throttle-valve switch or load potentiometer incorrectly set or defective	Check setting of throttle-valve switch and potentiometer and replace if necessary
X		X	X				X	X				Leak in air-induction system	Check for leak in intake manifold and all parts attached to it as well as for leak in hose connections
X		X			X	X	X					Injection valves defective	Check injection processes at valves. Disconnect current connection: there must be a drop in engine speed
X	X	X	X			X						Fuel pressure too low or no fuel pressure. Fuel filter/pre-filter contaminated	Check pressure, filter, fuel line, pressure regulator and fuel pump; replace contaminated filters
					X		X					Fuel pressure too high	Is connecting hose connected up between pressure regulator and intake manifold? Fuel return hose clogged or pinched off. Pressure regulator defective

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table "Renix" (continued)

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
X							X	X				Idle-speed control valve not functioning	Check function; replace if valve defective
X							X	X				Malfunction in idle-speed control-valve power supply	Check circuit and conformity of control unit; replace if defective or in the event of non-conformity
		X										EGR valve defective (engine Z7U)	Check for leaks and check calibration of opening; replace if defective
	X		X									Pulse segment at flywheel defective	Check segments on flywheel for uniformity and conformity
X	X											Sensor for intake-manifold pressure defective	Check connecting hose to intake manifold. Electrically check sensor (+ 5 V)
X												Pulse generator for engine speed defective	Check resistance and spacing
X	X					X						Ignition-power module defective	Check power supply of module and resistance of coil
	X							X	X	X		Sensor for intake-air temperature defective	Check resistance and circuit
X					X			X	X			Sensor for coolant temperature defective	Measure resistance and circuit
		X	X					X	X			Idle-speed regulation system or potentiometer for CO adjustment defective	Check idle-speed regulation system and CO adjustment; replace if necessary

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table "Renix" (continued)

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
X	X		X	X								Lambda sensor not functioning	Check idle-speed regulation system and replace lambda sensor if necessary
X												Throttle valve won't close	Free throttle valve; adjust linkage and then set throttle valve
		X										Throttle valve doesn't open completely	Adjust accelerator pedal
			X									Poor main/ground connection, plug contact defective	Check connections
X	X	X	X	X	X	X	X	X	X	X	X	Open-circuit in wiring harnesses and cable connections	Make proper connections
X	X	X	X	X	X	X				X	X	Electronic control unit defective	Check entire system before replacing control unit

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table "Renix" (continued)

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

												Cause	Remedy – check
						X					X	Knock sensor	Check transmission of signal at 3000 min $^{-1}$ for 10 s. If there is no signal present with engine running, check continuity. Replace sensor if it is defective
						X					X	Fuel quality, pulse generator for TDC	Check ignition-point correction value when idling without vacuum hose = 8° ± 1°. If value clearly differs from 0, check fuel quality, connections of TDC sensor, cooling system, spark plugs etc.
						X						No charge-air pressure (L 485)	Check max. charge-air-pressure setting at 3000 ± 500 min $^{-1}$. Check following with maximum value: mode of operation and connection of solenoid-operated valve, static opening pressure of wastegate

Fault table "Renix" (continued)

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

1	2	3	4	5	6	7	8	9	10	11	12	Cause	Remedy -- check
				X		X						Excessive charge-air pressure (L485)	Check max. charge-air-pressure setting at 3000 ± 500 min^{-1}. Check following with minimum value: mode of operation and connection of solenoid-operated valve, static opening pressure of wastegate
X			X	X	X	X	X	X	X			Mixture composition not adapted to engine temperature	Check conformity of sensors for coolant and intake-air temperature

This microcard was prepared exclusively for Bosch Service on behalf of ROBERT BOSCH GMBH STUTTGART

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Ingenieurbüro für Auto-Technik

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The BOSCH equipment and the test specifications/ settings for BOSCH products and components are always to be taken from the BOSCH microcards. Test specifications and circuit diagrams are contained in the microcards and workshop documentation already introduced into BOSCH after-sales-service workshops.

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Renix multi-point injection

Installed in the following Renault models:

R5, R9, R11, R19, R21, P25, Espace and Alpine

The ignition system is likewise an integral feature of this fuel injection system which has been installed since September 1984/October 1986.

Systems without catalytic converter are built for vehicles which only conform to the European ECE Emission Standard.

Vehicles, which have to satisfy the US-83 Standard, are always equipped with lambda sensor and 3-way catalytic converter.

1. Design and function

a) The central control unit uses the data obtained from the various information sensors to produce electric signals for actuating the injection valves, the fuel pump, the idle-speed control valve and the ignition-power module.

The main information variables, from which the control unit calculates the basic duration of injection, are the intake-manifold pressure and the engine speed.

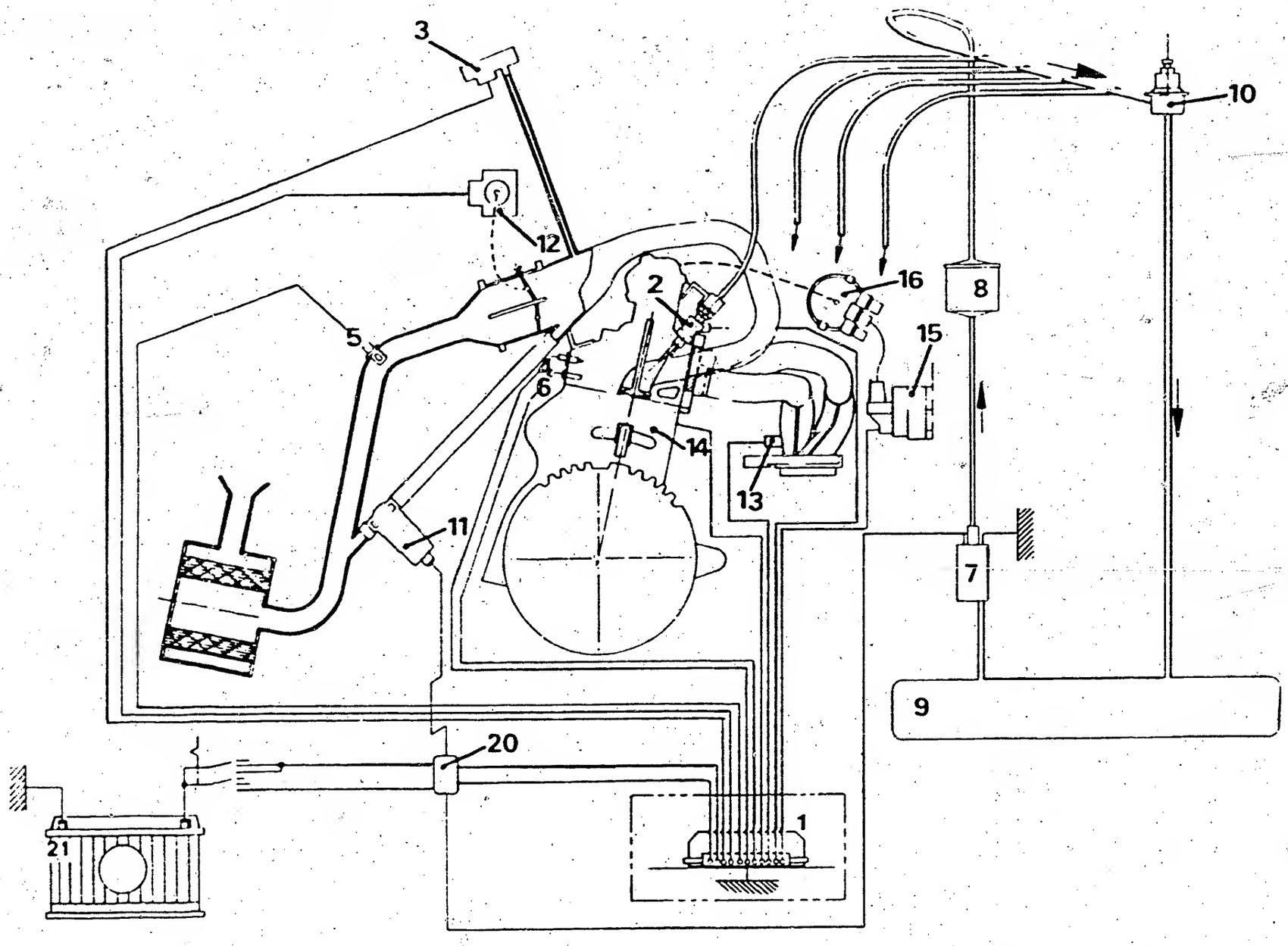
The basic time is corrected on the basis of measured values from the air and coolant-temperature sensor, the lambda sensor, the knock sensor, the full-load and the idle contact switch, as well as on the basis of information on the battery voltage and starter actuation.

b) The injection valves - one per cylinder - are actuated (1 x) simultaneously with every revolution of the crankshaft.

In view of the fact that the injection pressure is constant, the amount of fuel injected is only a function of the opening time of the valves.

An idle-speed control valve provides compensation for changes in load or disturbances which would result in a decrease in idle speed.

A fault memory and a limp-home program are also provided.



WS000178

Design of Renix fuel-injection and ignition system

1 = Control unit
2 = Injection valve
3 = Intake-manifold-pressure sensor
4 = Coolant-temperature sensor
5 = Intake-air-temperature sensor
6 = Knock sensor
7 = Fuel pump
8 = Fuel filter
9 = Tank
10 = Pressure regulator
11 = Idle-speed control valve
12 = Throttle-valve switch
13 = Lambda sensor
14 = TDC and engine-speed sensor
15 = Ignition-power module
16 = Ignition distributor
20 = Main relay
21 = Battery

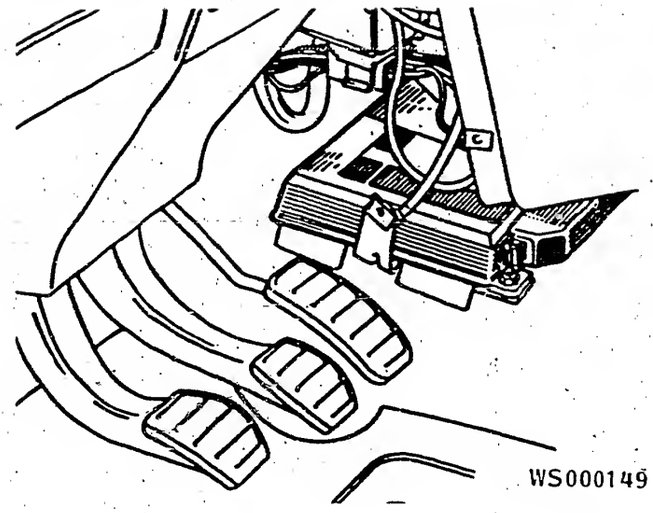
1.1 Fuel system

The electric roller-cell pump features a relief valve and a check valve at the pump outlet, so as to maintain the fuel pressure when the engine is switched off. The pump is located at the fuel tank. Its terminals are marked with + and −.

The pressure regulator regulates the return flow of fuel to the tank in such a manner that the injection pressure remains constant as a function of the vacuum prevailing in the intake manifold. The task of the pressure damper is to damp changes in pressure and reduce noise.

The solenoid-operated injection valves are installed in the intake manifold. They squirt the fuel in front of the intake valve on a synchronous basis 1 x per crankshaft revolution.

The position of the control unit beneath the center console in the Renault Espace is shown in the picture.
On other models, the unit is located in the engine compartment; with the Alpine it is positioned behind the backrest.



1.2 Control unit and sensor

The control unit contains the maps for fuel injection and ignition. It is located in a sealed protective housing in the engine compartment.

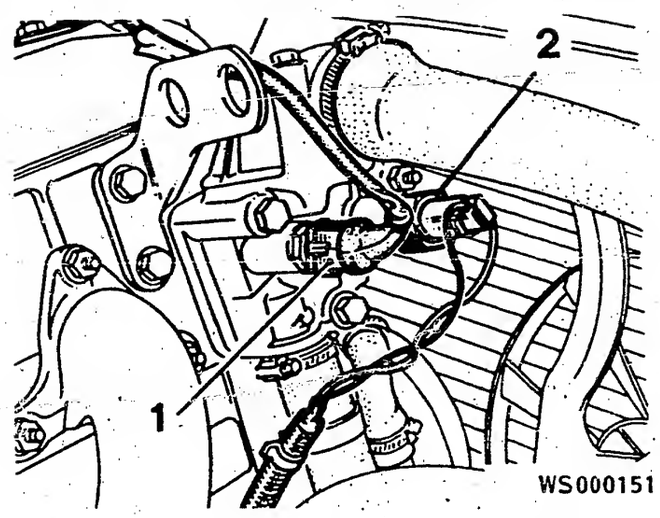
The coolant temperature sensor (top picture (1)) installed in the coolant circuit at the water pump and the intake-air-temperature sensor (bottom picture) mounted upstream of the throttle housing are either CTP or CTN sensors depending on engine type. CTP sensors increase the resistance with increasing temperature; CTN sensors reduce the resistance with increasing temperature.

The TDC and engine-speed sensor is a magnetic sensor with inductive winding.

Pulse segments on the flywheel are used to determine the angular velocity and thus the engine speed, as well as to establish the dead center.

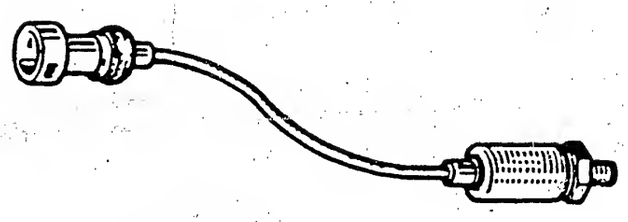
In the case of the 4-cylinder version, two extra-wide segments are located 90° before the dead centers in each case.

On the 6-cylinder version, three broad segments are distributed around the periphery.



1 = Coolant-temperature sensor
2 = Thermo-switch for cooling fan

Intake-air-temperature sensor with plug



WS000139

The intake-manifold-pressure sensor (top picture) measures the vacuum prevailing in the intake manifold.

Use is made for measurement purposes of a piezoelectric crystal.

The sensor is supplied with a voltage of 5 V.

The control unit obtains information on the throttle-valve position either from the throttle-valve switch (bottom picture) or from the throttle-valve potentiometer.

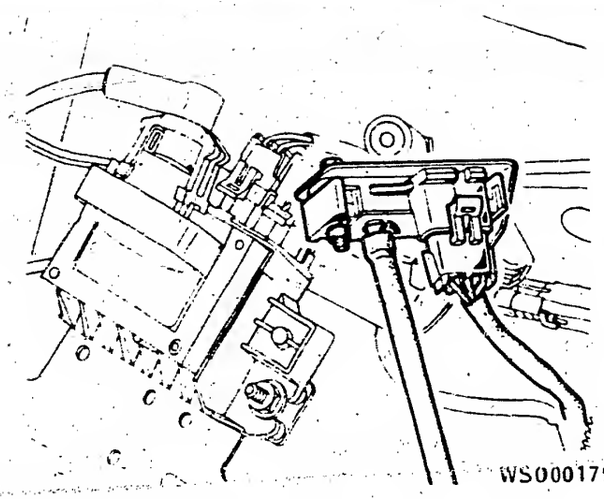
The throttle-valve switch only has on/off switching functions.

Full load is signaled as of 10° prior to full opening of the throttle valve; idle as of 2° prior to total closure.

The switch is to be found in two different versions depending on engine type.

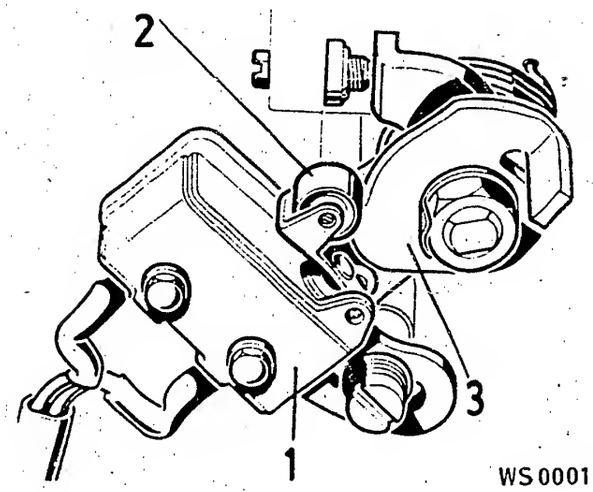
The throttle-valve potentiometer supplies precise data concerning the throttle valve position over the entire range.

Information as to necessary mixture corrections come from the lambda sensor in the case of the catalytic-converter engine; this task is assumed by the potentiometer for the idle mixture in the case of ECE vehicles.



Intake-manifold-pressure sensor. It may also be installed at the bottom of the ignition module

Throttle-valve switch:
1 = Switch
2 = Contact roller
3 = Throttle-valve cam



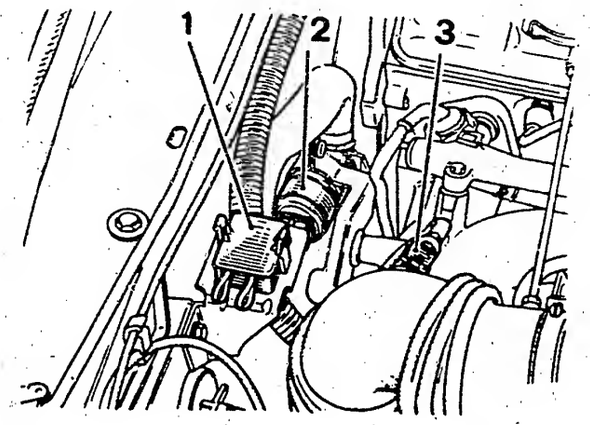
1.3 Further components and special features

The system provides automatic compensation for fluctuations in idling speed with the aid of the idle-speed control valve. The angle of function of the rotary piston – which is controlled with two motors – is 90°. The cold idle speed is between 1000 and 1100 min $^{-1}$ as long as the coolant temperature is below 20°C.
The ignition-power module contains the power section and the ignition coil. Ignition timing is effected in line with the pressure/speed map taking account of the various correction variables.

Knocking combustion is detected and indicated to the control unit by the piezoelectric knock sensor. In the non-critical area – i.e. at low engine speeds and with small loads – such a message from the knock sensor effects a rapid retard by 7°, with the original value then being assumed again after roughly 10 seconds. In the critical area, the above-described retard by 7° is effected, to be followed by the normalization phase to the rated value –1°. The rated value is finally attained again in a few minutes in the course of a second, slow correction phase. Should the knock sensor fail, the system effects gradual retardation in the critical area by 3° from the rated value. The knock control is selective, i.e. cylinder-specific.

When the engine is started, the control unit receives a pulse from the starter control relay. In this phase, the coolant temperature is the sole factor on which calculation of the duration of injection is based. The injection valves are actuated twice per crankshaft revolution. Moreover, the control unit ensures a favorable ignition point in this phase. Overrun cutoff comes into effect if the throttle valve is completely closed and the engine speed is in excess of roughly 2000 min $^{-1}$. Injection is initiated again if the throttle valve is opened or the engine speed drops below 1100 min $^{-1}$.
To stop the duration of injection being falsified by fluctuations in battery voltage (8...16 V), the injection time is regulated as a function of battery voltage.
The atmospheric pressure is measured whenever the starting motor is actuated and stored in the control unit. This value is corrected whenever the throttle valve is fully opened and if the measured pressure is greater than the atmospheric pressure. Measurement of the atmospheric pressure is used to adapt the quantity of fuel injected to the difference in altitude.

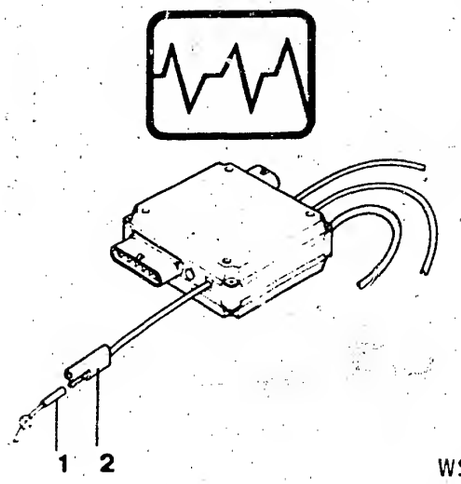
Malfunctions in the system are recorded by the control unit. An indication is given by way of the warning lamp in the instrument panel or in the form of fault codes on the tester. The control unit replaces missing or implausible input values by means of fixed values.



WS000181

1 = Diagnosis plug
2 = Idle-speed control valve
3 = Throttle-valve cam

1 = Plug
2 = Plug



WS000182

2. Safety precautions

- Never detach electrical connections without previously switching off the ignition.
- When performing electric welding work, disconnect control unit and remove in the case of temperatures in excess of 80° (stove-enamelling booths).
- Disconnect battery for recharging purposes.
- Before opening fuel system, always pull out 6-pole plug at ignition module.
- Always pull out plug of control unit before testing sensors or cable connections.
- The control unit cannot be tested on its own.
- When performing tests with voltmeter and ohmmeter or indicator lamp, only make use of high-impedance devices and proceed with caution, so as to prevent short-circuits and to make sure incorrect terminals are not connected together.
- A pressure gauge is also required in addition to voltmeter, ohmmeter and indicator lamp.

3. Testers

A special portable test set "XR 25", which is connected to the central diagnosis plug, is available for reading out the stored faults and for comprehensive system testing.

If such special equipment is not available, faults can be located and eliminated for example on the basis of the table A.

The most important tests and adjustments are described in the following.

4. Tests and adjustments

a) Fuel pressure and pump delivery

The fuel pressure must be 2.5 ± 0.2 bar with the vacuum line detached. If a vacuum of 500 bar is applied to the pressure regulator, the pressure indicated on the pressure gauge must drop to 2.0 bar.

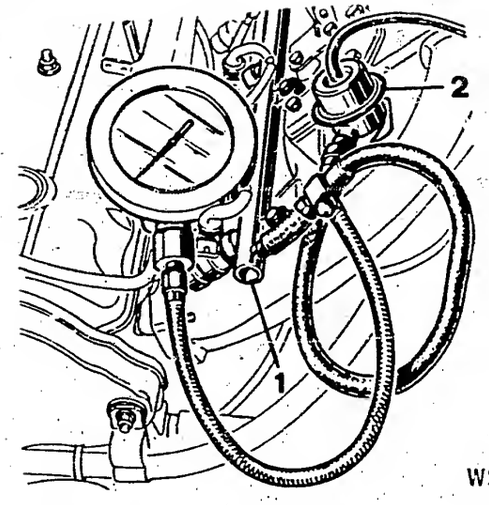
If the return line to the tank is interrupted for several seconds (pinched off), the pressure must increase to in excess of 5 bar.

To check the pump delivery, the return hose is to be disconnected and held over a graduate.

The fuel pump is actuated with the control unit disconnected by connecting connections 3 and 5 at the plug of the pump relay.

Delivery in 30 s: more than 1 liter.

If the delivery is inadequate, the supply voltage of the pump is first to be checked.



WS000183

Fuel-pressure test:
1 = Connection to fuel rail
2 = Pressure regulator

b) Injection valves

To check the injection valves for leaks, they are to be removed together with the fuel rail and disconnected from the plug connections.

If the supply pump is now actuated as described above, the valves must not drip.

The resistance between the terminals is 2.5 ± 0.5 Ω .

c) Throttle housing

1) Engine F3N: The throttle-valve switch is to be set by means of the adjusting screws E shown in the top picture such that the following resistance values are obtained at the plug connections:

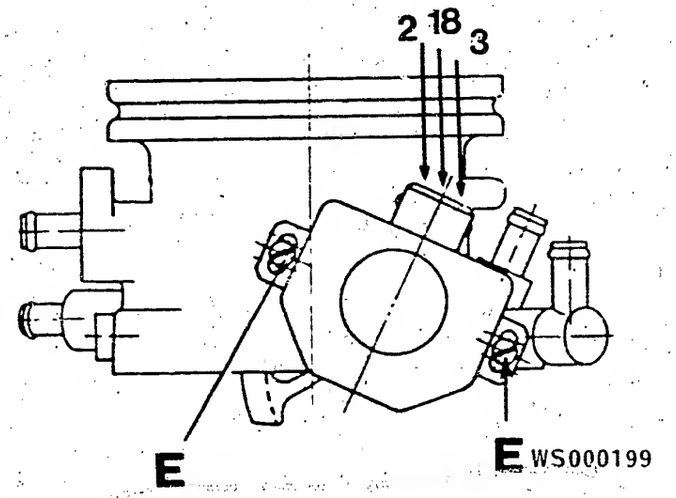
Throttle-valve position	Resistance between terminals 2 and 18	18 and 3
Idle	0 Ω	infinity
Part load	infinity	infinity
Full load	infinity	0 Ω

2) Engine J7T: The above table again applies. The dimension X (bottom picture) at the stop is however valid for the proposed throttle-valve opening in accordance with the following table:

Idle: X < 0.2 mm

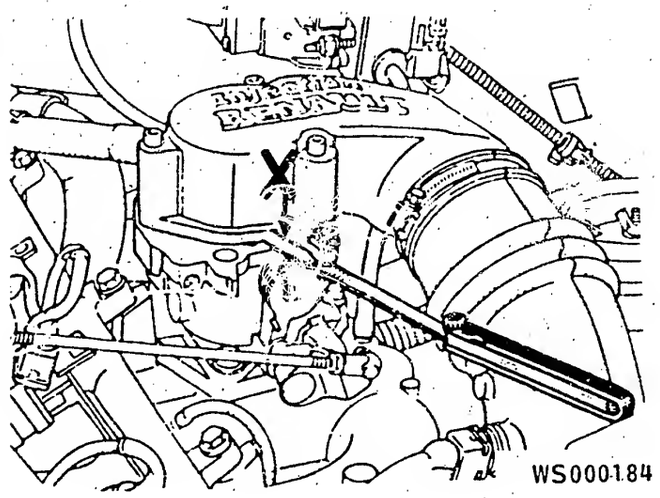
Part load: X > 0.3 mm

Full load: Throttle-valve opening 70°, 22 mm drill shank between throttle valve and housing.



Adjustment of throttle-valve switch by means of adjusting screws E

X = Adjustment dimensions

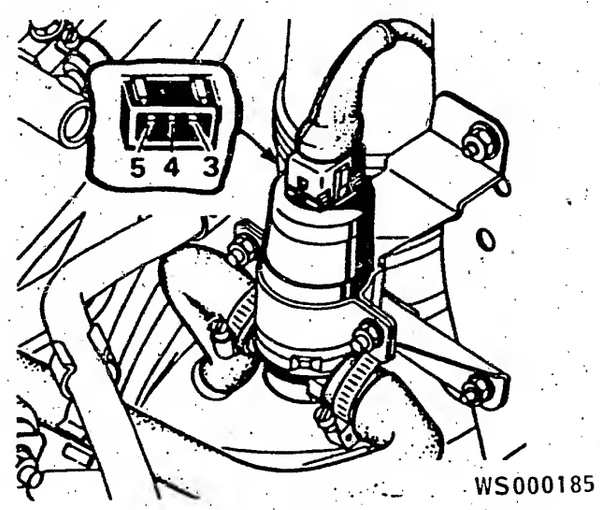


e) Idle-speed control valve

For test purposes, 12 V is to be applied to terminal 4 (see top picture) at the plug connection.

If terminal 3 is then connected to ground, the valve must close and there must be a drop in idle speed with the engine running.

If terminal 5 is connected to ground, the valve opens and the engine speed increases to in excess of 2000 min^{-1} .



Testing of idle-speed control valve with plug connections 3, 4 and 5

f) Intake-air and coolant temperature sensor

The temperature-dependent resistance values of the two sensors can be seen from the table below which also gives an indication of the type.

Resistance values in Ω

Coolant-temperature sensor

Engine type	Sensor type	Temperature 20 ± 1° C	80 ± 1° C	90 ± 1° C
F3N, J7T, Z7U	CTP	283... 297	333...397	403...417
J7T	CTN*	2200...2800	280...370	
Z7W	CTN**	3061...4045	301...367	212...273

Air-temperature sensor

Engine type	Sensor type	Temperature 0 ± 1° C	20 ± 1° C	40 ± 1° C
F3N, J7T, Z7U	CTP	254 ... 266	283... 297	315... 329
Z7W	CTN	7469...11970	3061...4045	1289...1654

* Bosch
** Bendix

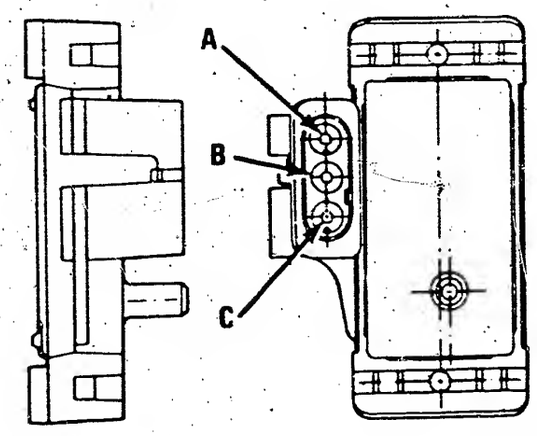
g) Intake-manifold-pressure sensor

Check condition of vacuum hose and check for presence of calibration (Eng. Z7U, J7T = 1.2 mm; Eng. Z7W, J7T = 1.5 mm).

Absolute-pressure or intake-manifold-pressure sensor (top picture) with following connections:

A = Ground
B = Output voltage
C = Power supply 5 V.

The ground lead A is to be tested for continuity between sensor and control-unit plug.

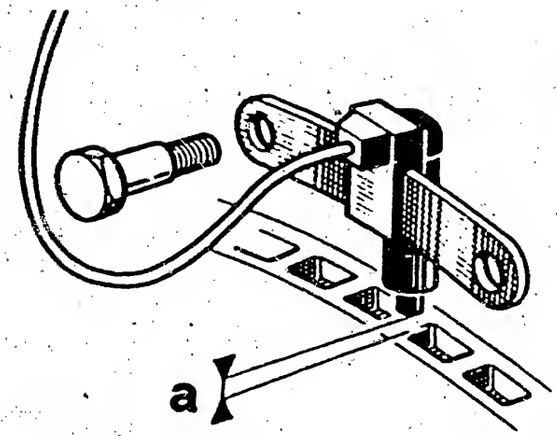


WS000170

h) TDC and engine-speed sensor

The resistance at the plug of the pulse generator is 200 Ω .

The distance (see center picture "a") between the sensor and the flywheel should be 1.0 ± 0.5 mm.
Adjustment, on the other hand, is not possible.
A new sensor is to be fitted if the distance is not correct.



WS000186

i) Potentiometer for idle-mixture regulation

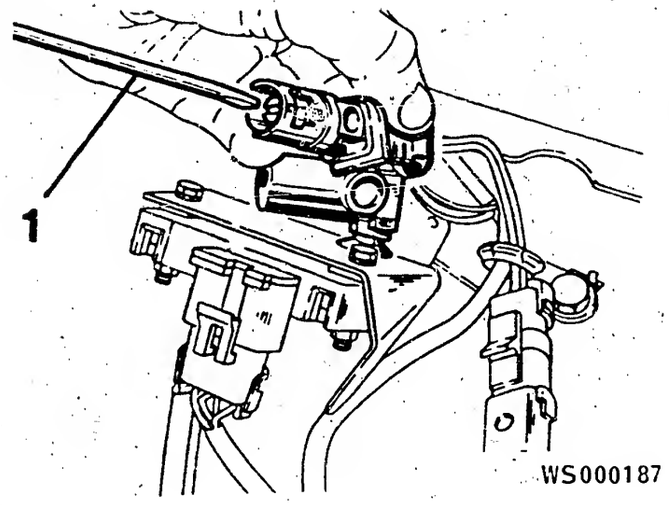
Mixture correction can be performed by way of this potentiometer for vehicles with no catalytic converter.

For test purposes, the resistance at the plug (see bottom picture) is to be checked.

The resistance values are as follows: 200 Ω at the counter-clockwise stop and 10,000 Ω at the clockwise stop.

The maximum adjustment is 3/4 turns (270° ± 5°).

Potentiometer for regulating idle mixture on vehicles with no catalytic converter (1 = screwdriver).



WS000187

3. Installation locations of control units and relays

R5: Control unit and relays are located on the passenger's side beneath the glove compartment behind a plastic cover.

R9 and R11:
The control unit is installed in the engine compartment at the left-hand spring-strut dome.
It is enclosed in a protective sheath.
The relays are likewise located in the engine compartment next to the ignition-power module.

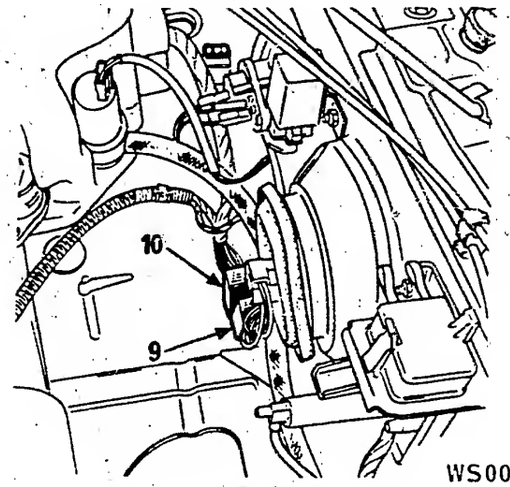
R19: The control unit is located front right; the relays front left in the engine compartment beneath a plastic cover.

R21: Control unit and relays are installed beneath a plastic hood behind the left-hand spring-strut dome.

R25: Control unit and relays are located in a protective housing in the engine compartment on the left-hand wheel-house side.

Espace:
The control unit is accessible following removal of the left-hand center-console trim. The relays are to be found in the engine compartment under the left-hand headlight.

Alpine:
Control unit and relays are located at the rear in the center section of the back rest.



Position of fuel-pump relay (9) and fuel-injection relay (10) in engine compartment of Espace

4. Fuel-vapor absorption system

The vehicles are provided with a fuel-vapor absorption system in countries where extremely stringent emission regulations apply (US-83 version).

This system consists of an active-carbon can (see picture), a solenoid-operated valve and the corresponding lines.

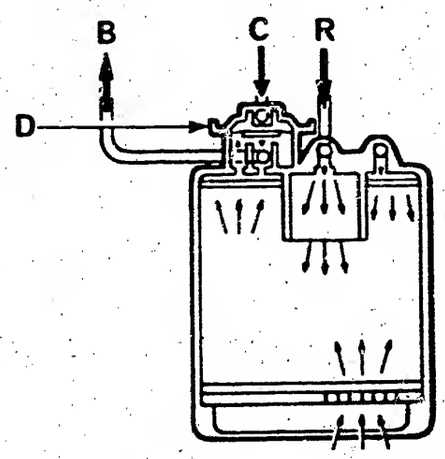
A calibration facility (2 mm in Espace) is also provided in the intake-manifold connection in the direct line between can and intake manifold.

a) Notes on operation: The vapors from the fuel tank can collect in the active-carbon can when the engine is stopped.

When idling, a small amount of the vapor is drawn off via the direct line and the above-mentioned calibration facility.

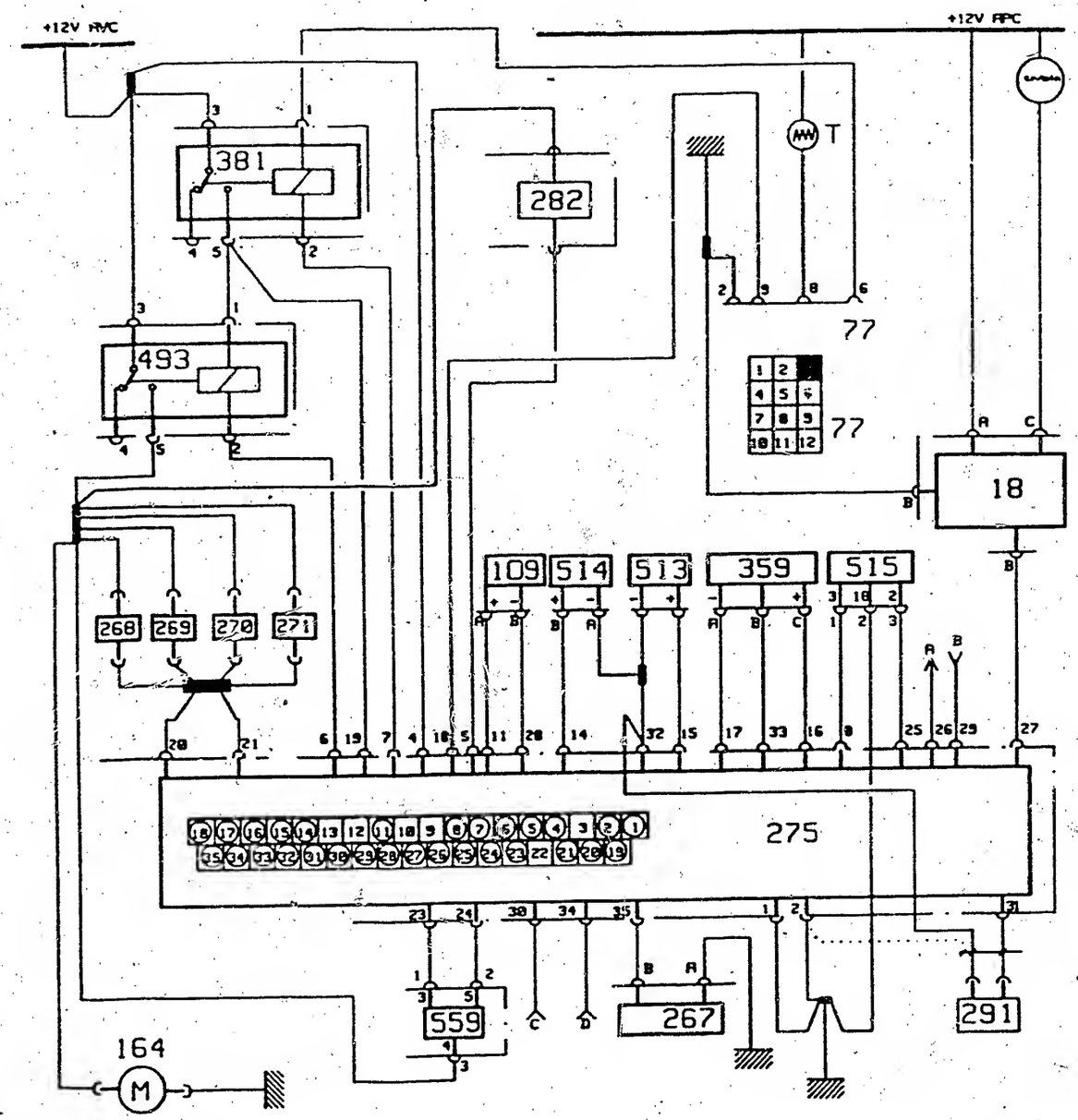
At higher speeds and when the engine is at operating temperature, the solenoid-operated vacuum valve is actuated by the electronic control unit, with the result that there is pronounced ventilation of the carbon can via the additional vent line (C in top picture).

b) Malfunctions: A defect in the solenoid-operated vacuum valve can have an adverse effect above all on idling.
In such cases, a check is to be made on the electrical connections, the solenoid-operated valve, the control signal (ground) of the control unit and the connecting hoses.



WS000189

B = Vent line
C = Solenoid-operated valve connection
D = Valve unit
R = Supply line to can



Schematic representation of Renix multi-point injection system for catalytic-converter engines:

18 = Ignition module
77 = Diagnosis plug
109 = Engine-speed sensor
164 = Fuel pump
267 = Lambda sensor
268 = Injection valve
269 = Injection valve
270 = Injection valve
271 = Injection valve
275 = Control unit
282 = Solenoid-operated valve of fuel-vapor absorption system
291 = Knock sensor
359 = Pressure sensor
381 = Supply relay
493 = Fuel-pump relay
513 = Coolant-temperature sensor
514 = Air-temperature sensor
515 = Throttle-valve switch
559 = Idle-speed control valve
B = Starter signal input
T = Malfunction indicator

Fault table A

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

1	2	3	4	5	6	7	8	9	10	11	12	Cause	Remedy – check
X	X											Relay defective, switching duration 3 s	Test power supply with voltage being applied
X	X			X								Fuel pump won't run	Check fuel pressure. Is voltage provided at relay and fuel pump? If yes, replace fuel pump
		X	X		X					X		Throttle-valve switch or load potentiometer incorrectly set or defective	Check setting of throttle-valve switch and potentiometer and replace if necessary
X		X	X				X			X		Leak in air-induction system	Check for leak in intake manifold and all parts attached to it as well as for leak in hose connections
X		X			X	X	X					Injection valves defective	Check injection processes at valves. Disconnect current connection: there must be a drop in engine speed
X	X	X	X			X						Fuel pressure too low or no fuel pressure. Fuel filter/pre-filter contaminated	Check pressure, filter, fuel line, pressure regulator and fuel pump; replace contaminated filters
				X		X						Fuel pressure too high	Is connecting hose connected up between pressure regulator and intake manifold? Fuel return hose clogged or pinched off. Pressure regulator defective

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table A (continued)

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
X							X	X				Idle-speed control valve not functioning	Check function; replace if valve defective
X							X	X				Malfunction in idle-speed control-valve power supply	Check circuit and conformity of control unit; replace if defective or in the event of non-conformity
		X							X			EGR valve defective (engine Z7U)	Check for leaks and check calibration of opening; replace if defective
			X		X							Pulse segment at flywheel defective	Check segments on flywheel for uniformity and conformity
X	X											Sensor for intake-manifold pressure defective	Check connecting hose to intake manifold. Electrically check sensor (+ 5 V)
X												Pulse generator for engine speed defective	Check resistance and spacing
X	X				X							Ignition-power module defective	Check power supply of module and resistance of coil
	X							X	X	X		Sensor for intake-air temperature defective	Check resistance and circuit
X							X		X	X		Sensor for coolant temperature defective	Measure resistance and circuit
			X	X				X	X			Idle-speed regulation system or adjustment potentiometer defective	Check idle-speed regulation system and CO adjustment; replace if necessary

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

Fault table A (continued)

1. Engine fails to start or starts only with difficulty 2. Engine starts but then dies 3. Idle problems 4. Poor throttle take-up 5. Engine missing in all speed ranges 6. Fuel consumption too high 7. Max. engine power not reached 8. Excessive CO level in exhaust gas when idling 9. Not enough CO in exhaust gas when idling 10. Engine knocking 11. Idle speed too high 12. Idle speed too low (engine cuts out)												Note The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.
												Cause — Remedy – check
X	X			X	X							Lambda sensor not functioning — Check idle-speed regulation system and replace lambda sensor if necessary
X												Throttle valve won't close — Free throttle valve; adjust linkage and then set throttle valve
						X						Throttle valve doesn't open completely — Adjust accelerator pedal
				X								Poor main/ground connection, plug contact defective — Check connections
X	X	X	X	X	X	X	X	X	X	X	X	Open-circuit in wiring harnesses and cable connections — Make proper connections
X	X	X	X	X	X	X				X	X	Electronic control unit defective — Check entire system before replacing control unit

Fault table A (continued)

1. Engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems
4. Poor throttle take-up
5. Engine missing in all speed ranges
6. Fuel consumption too high
7. Max. engine power not reached
8. Excessive CO level in exhaust gas when idling
9. Not enough CO in exhaust gas when idling
10. Engine knocking
11. Idle speed too high
12. Idle speed too low (engine cuts out)

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

			Cause	Remedy – check
X		X	Knock sensor	Check transmission of signal at 3000 min $^{-1}$ for 10 s. If there is no signal present with engine running, check continuity. Replace sensor if it is defective
X		X	Fuel quality	Check ignition-point correction value in line with vehicle type.
			Pulse generator for TDC	If value clearly differs from 0, check fuel quality, connections of TDC sensor, cooling system, spark plugs etc.
X			No charge-air pressure (L 485)	Check 895 mbar setting for max. charge-air pressure at 3000 ± 500 min $^{-1}$. Check following with maximum value: Mode of operation and connection of solenoid-operated valve, static opening pressure of wastegate

Fault table A (continued)

1. Engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Idle problems	4. Poor throttle take-up	5. Engine missing in all speed ranges	6. Fuel consumption too high	7. Max. engine power not reached	8. Excessive CO level in exhaust gas when idling	9. Not enough CO in exhaust gas when idling	10. Engine knocking	11. Idle speed too high	12. Idle speed too low (engine cuts out)	Cause	Remedy – check
				X			X					Excessive charge-air pressure (L 485)	Check 895 mbar max. charge-air pressure setting at 3000 ± 500 min $^{-1}$. Check following with minimum value: Mode of operation and connection of solenoid-operated valve, static opening pressure of wastegate
X			X	X	X	X	X	X	X			Mixture composition not adapted to engine temperature	Check conformity of sensors for coolant and intake-air temperature

Note
The checks and remedies as described in this table presuppose that the engine is in perfect working order and that the electrical system has been tested and repaired if necessary.

TECHNICAL DATA

Engine type	F3N	J7T	Z7W	Z7U
Code number	702/708/722/742	732 (1)/754 (2)/770	706 (3)	734
Vehicle	R5/R9/R11/R21/R19	R25/R21/Espace	R25	Alpine
Bore/stroke (mm)	81.0 / 83.5	88 / 89	91 / 73	91 / 63
Capacity (cm^3)	1721	2165	2849	2458
Compression	9.5	9.2	9.5	8.0
Idle speed (min^{-1}) n.a.	800 ± 50	800 ± 25	800 ± 50	700 ± 50
CO content (vol. %) n.a.	< 0.5	< 0.5	< 0.5	< 0.5
Quantity of fuel injected (test specification per injection valve) (ml/min.)	216	216	216	216
Fuel pressure (bar)	2.5 ± 0.5	2.5 ± 0.5	3.0 ± 0.2	3.0 ± 0.2
Resistance of injection valves (Ω)	2.5 ± 0.5	2.5 ± 0.5	2.5 ± 0.5	2.5 ± 0.5
Throttle housing	Weber 32-36 CFR	Solex dia. 50	Solex 55	Solex 55
Idle-speed control valve	Bosch	Bosch	Bosch	Bosch
Intake-air-temperature sensor	Bendix, CTP	Bendix, CTP	Bendix, CTN	Bendix, CTP
Coolant-temperature sensor	Bendix, CTP	Bendix, CTP	Bendix, CTN	Bendix, CTP
Lambda sensor	Bosch	Bosch	Bosch	Bosch
Voltage, rich mixture (mV) *	625...1100	625...1100	625...1100	625...1100
Voltage, lean mixture (mV) *	0...150	0...150	0...150	0...150

* = at 800°C
n.a. = not ajustable
(1) = Automatic: 733
(2) = Automatic: 755
(3) = Automatic: 701

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J. Pfyl-Ing. HTL
Ingenieurbüro für Auto-Technik

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For production reasons:
continued on the following coordinate.

1. Design and function

The Renix ignition system (AEI) is fully electronic. The flywheel is provided with gear teeth (40 teeth). Two additional teeth are twice as wide and offset by 180° with respect to one another. They are used to determine the TDC position, whereas the normal teeth indicate the engine speed to the control unit by way of the pulse generator with permanent magnet and induction coil which is fixed to the housing.

The control unit installed in the passenger compartment of the R5 beneath the glove compartment calculates the most favorable ignition point on the basis of the engine speed and intake-manifold vacuum and provides the electronic ignition module with information on certain corrections and special conditions.

The rev counter is also connected to the ignition module.

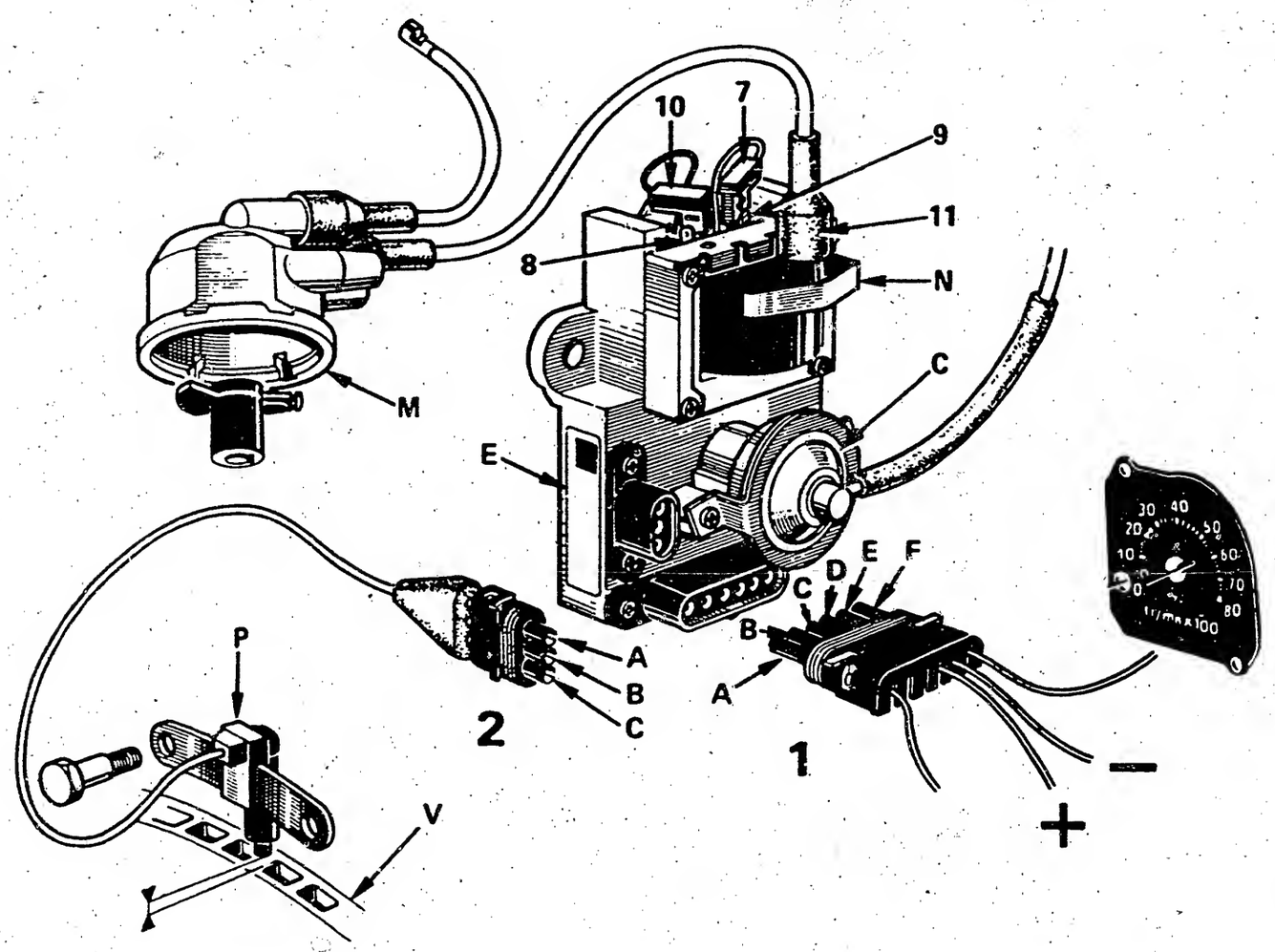
2. Safety precautions

- Never allow high voltage to spark over on to the electronic ignition module.
- Do not ground primary and secondary connections of ignition coil.
- Never start engine with battery terminals disconnected.
- Do not effect starting with fast charger.
- Never disconnect battery with engine running.
- Remove control unit at temperatures in excess of 80°C (stove enamelling).
- Disconnect battery before performing electric welding work.
- Never connect or disconnect plug of control unit with ignition switched on.

3. Testers

The ignition system can be tested with conventional equipment such as

- voltmeter and ohmmeter
- test lamp and timing light.



WS000133

Ignition system with plugs 1 and 2

1A = Altitude correction for ignition advance (only in the case of injection with throttle housing)
1B = Not used
1C = "Normal" ignition advance (only in the case of injection with throttle housing)
1D = Battery +
1E = Ground
1F = Rev counter
2A = Pulse generator
2B = Pulse generator
2C = Not used

C = Vacuum unit
E = Ignition module
M = Distributor cap
N = Ignition coil
P = Pulse generator
V = Flywheel
7 = Terminal, ignition coil
8 = Terminal, ignition coil
9 = Cable, ignition coil
10 = Cable, ignition coil
11 = Secondary voltage

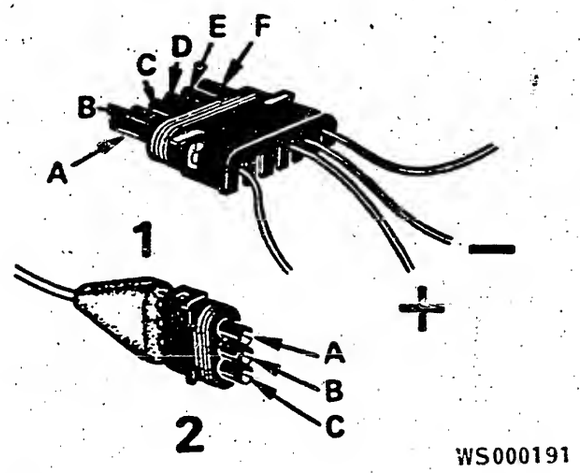
4. Trouble-shooting and measurement procedures

a) If there is no ignition voltage

- First visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- Detach plugs 1 and 2 (see top picture); clean pins if necessary and connect/disconnect plugs several times.

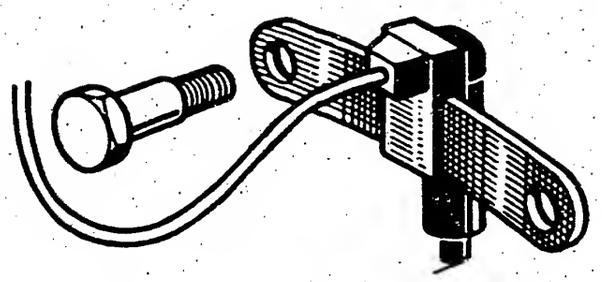
Measurement conditions	Measurements	Diagnosis
Detach plug 1, switch on ignition Operate starter	Control-unit voltage between + terminal and vehicle ground = > 9.5 V	Check battery voltage Check supply of current to control unit
	"Go"	
Detach plug 1, switch off ignition	Resistance between plug ground and vehicle ground = 0 Ω	Check ground cable of control unit
	"Go"	
Detach plug 1, switch off ignition	Voltage at ignition coil = 0 V	Replace control unit
	"Go"	
Connect plug 1, switch on ignition	Plug connection and vehicle ground = > 9.5 V	Check plug contacts and connection to ignition coil
	"Go"	



WS000191

1A = Altitude correction for ignition advance (only in the case of injection with throttle housing)
1B = Not used
1C = "Normal" ignition advance (only in the case of injection with throttle housing)
1D = Battery +
1E = Ground
1F = Rev counter
2A = Pulse generator
2B = Pulse generator
2C = Not used

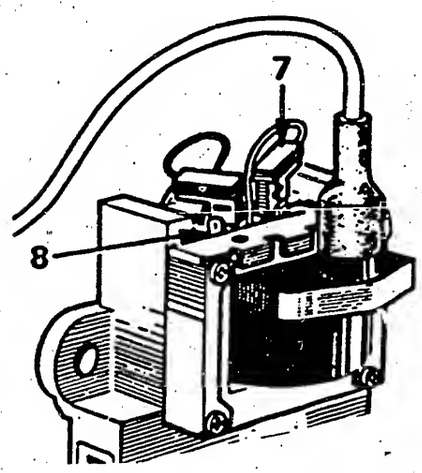
Measurement conditions	Measurements	Diagnosis
Detach plug 2, switch off ignition	Pulse–generator resistance = 200 ± 50 Ω	Replace pulse generator
	"Go"	
	Distance between pulse generator and flywheel = 1 mm ± 0.5	Replace pulse generator
	"Go"	
Plugs 1 and 2 connected, ignition coil disconnected, starter in operation	Indicator lamp between cable 7 and 8 connected, must flicker	Replace control unit
	"Go"	
Ignition coil removed	Resistance of secondary winding = 2–12 k Ω	Replace ignition coil
	"Go"	
Ignition coil removed	Resistance of primary winding 0.4–0.7 Ω	Replace ignition coil
Plug 1 detached	Insulation of rev counter = > 20 k Ω	Replace wiring harness or rev counter
	"Go"	
	No secondary voltage	Replace control unit.



WS000135

The pulse generator cannot be adjusted

Connect up indicator lamp between cables 7 and 8



WS000190

b) Starting problems, however trouble-free with engine running

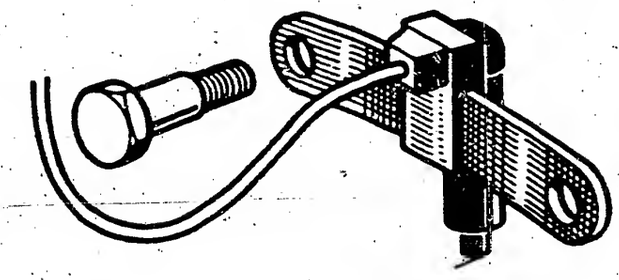
- Visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- H.T. check with spark tester.
  Spark length = at least 2 cm.

Operate starter	Powerful, uniform spark; if not, voltage of control unit = > 9.5 V	Control unit, battery condition or charge
	"Go"	
	Carburetor or injection, compression, ignition point	
	"Go"	
	Resistance of pulse generator (term. A, B) = 200 ± 50 Ω	Replace if defective
	"Go"	
	Distance between pulse generator and flywheel = 1 ± 0.5 mm	Replace if incorrect

c) Check on vacuum unit:

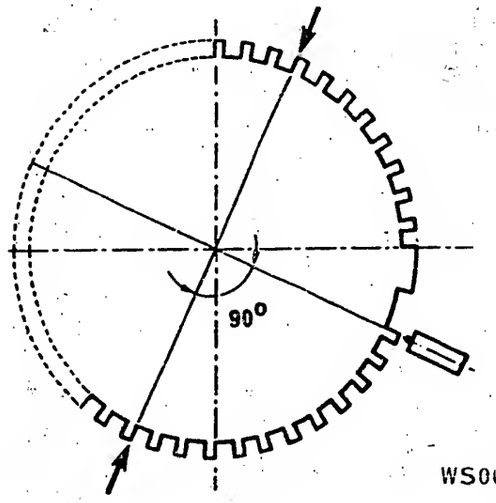
- Stabilize engine speed at 300 min^{-1}
- Detach vacuum hose at unit
- Engine speed decreases = vacuum unit O.K.
- Engine speed remains the same = check vacuum hose
- Vacuum hose O.K. = control unit defective; replace



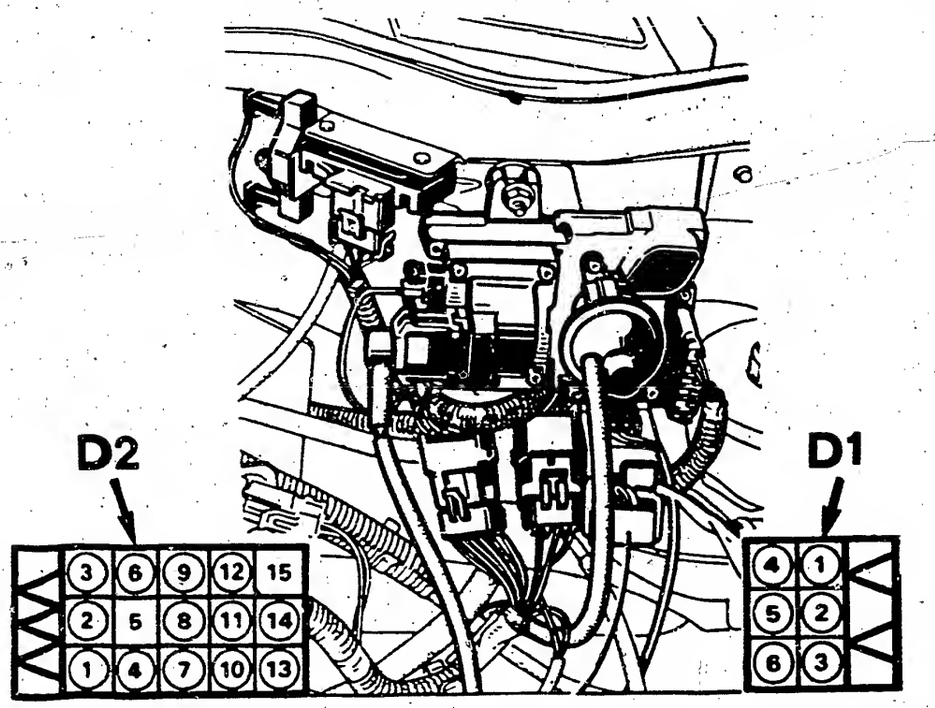
WS000135

The pulse generator cannot be adjusted

Pulse-generator system with narrow teeth for engine-speed determination and 2 broad teeth for determination of TDC



WS000134



WS000137

d) Ignition point and ignition timing

- The ignition point cannot be adjusted.
  For test purposes, allow engine to idle and detach hose to vacuum unit.
  Ignition advance with C3J engine = 8° ± 1° BTDC.
  The advance curve number is indicated on the plate on the ignition module.

e) Diagnosis plug

This is located together with the ignition module on a retaining plate in the engine compartment (top picture).
D1 is used to check the ignition; D2 to check the injection.

The following measurements can be carried out at the smaller plug (D1):
- at pin 2: check on primary circuit B+
- at pin 1: check on engine speed
- at pin 3: serves as vehicle ground.

f) Coolant-temperature sensor

There may be a connecting lead to the coolant-temperature sensor at the ignition module.

This retards the vacuum advance if the coolant temperature increases to in excess of 90° C.

5. Ignition distributor, spark plugs

The ignition distributor cannot be adjusted.
It merely distributes the high voltage to the individual cylinders.

Spark-plug type:	Champion RN-12YC
Electrode gap:	0.8 ± 0.05 mm

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RENAULT 9, 1.4 Turbo, 77 kW, engine C1J,
year of manufacture 1984/86

1. Design and function

The Renix ignition system (AEI) is fully electronic.
The flywheel is provided with gear teeth (40 teeth).
Two additional teeth are twice as wide and offset by 180° with respect to one another. These are used to determine the TDC position, whereas the normal teeth indicate the engine speed to the control unit by way of the pulse generator with permanent magnet and induction coil fixed to the housing.

The control unit calculates the most favorable ignition point on the basis of the engine speed and intake-manifold vacuum, and provides the electronic ignition module with information on certain corrections and special conditions.
The rev counter is likewise connected to the ignition module.

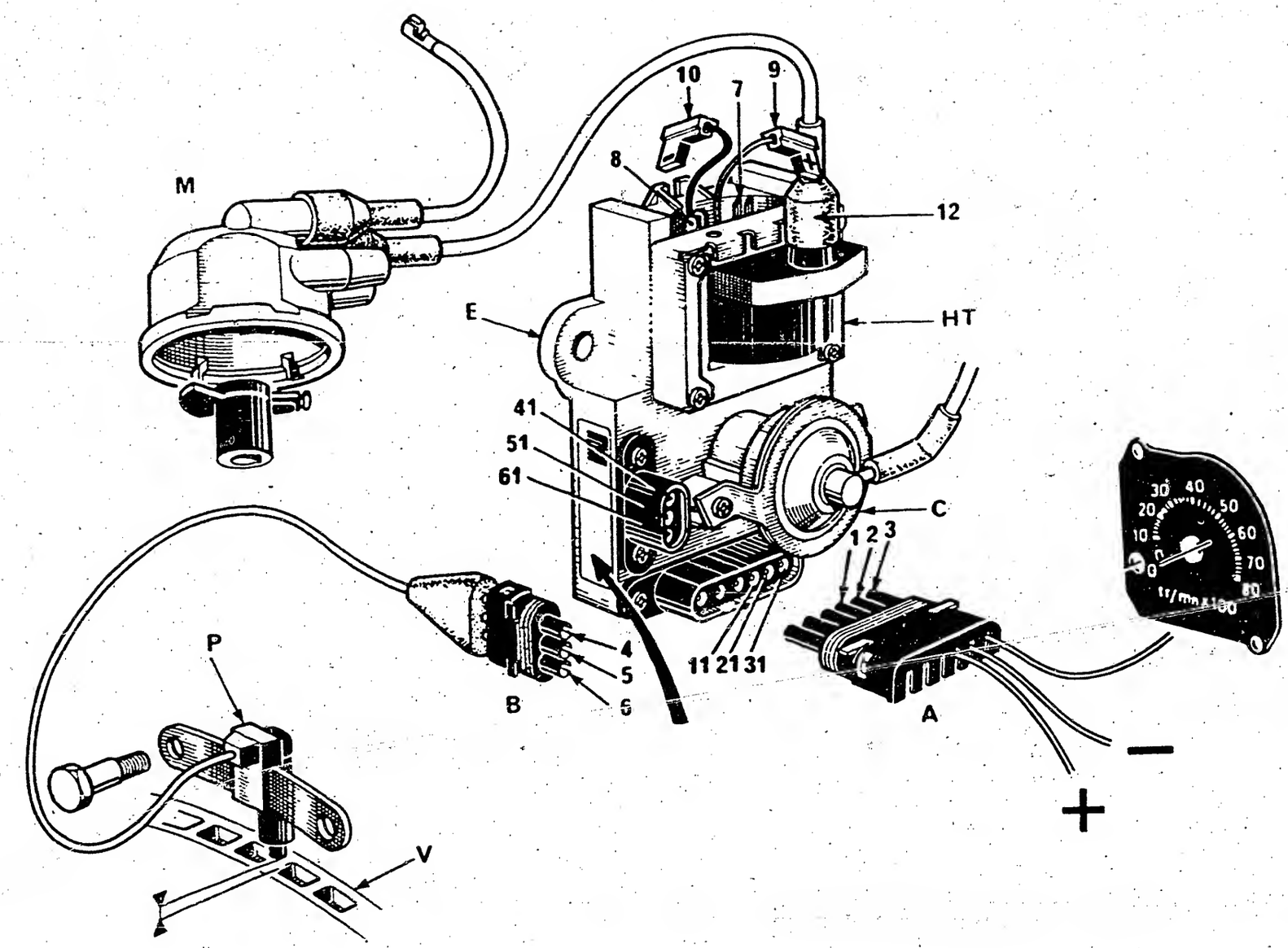
2. Safety precautions

- Never allow high voltage to spark over on to electronic ignition module.
- Do not ground primary and secondary connections of ignition coil.
- Never start engine with battery terminal disconnected.
- Do not effect starting with fast charger.
- Never disconnect battery with engine running.
- Remove control unit at temperatures in excess of 80°C (stove enamelling).
- Disconnect battery prior to performance of electric welding work.
- Plug of control unit is neither to be disconnected nor connected with ignition switched on.

3. Testers

The ignition system can be checked with conventional equipment such as

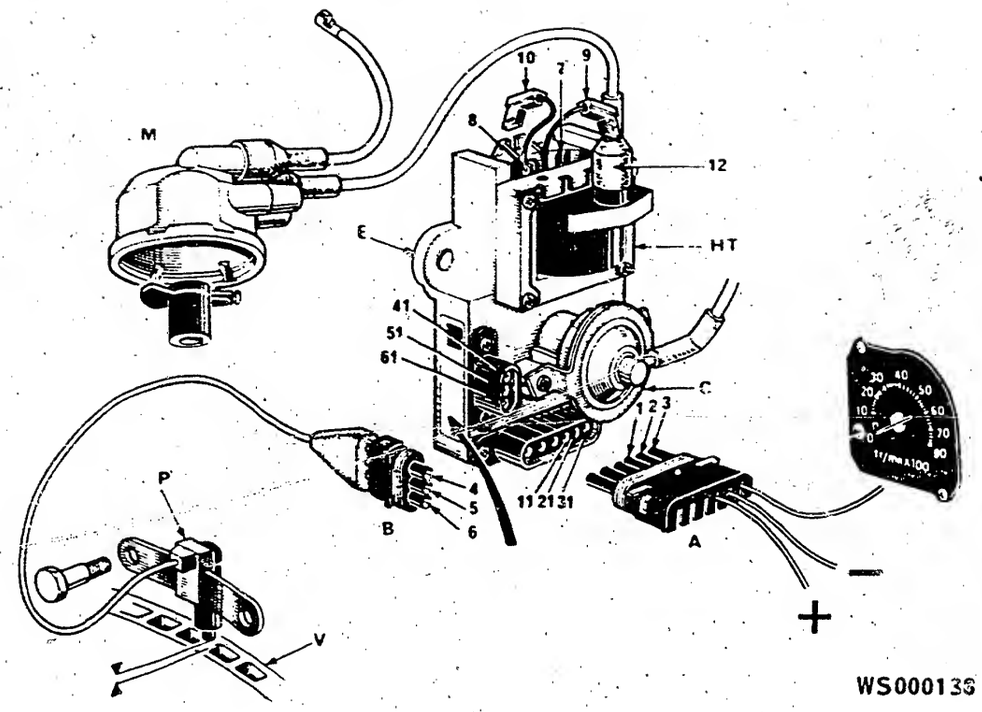
- Voltmeter and ohmmeter
- Test lamp and timing light.



WS000138

4. Electronic ignition system with various components:

1 = Current supply
2 = Ground
3 = Rev counter
4 = Generator winding
5 = Generator winding
6 = Screen
7 = Ignition-coil connection (+)
8 = Ignition-coil connection (–)
9 = Ignition-coil connector (+)
10 = Ignition-coil connector (–)
11 = Supply
21 = Ground (control unit)
31 = Output, rev counter
41 = Generator signal
51 = Generator signal
61 = Screen
A = Plug
B = Plug
C = Vacuum unit
E = Control-unit housing
HT= Ignition coil
M = Distributor cap
P = Pulse generator
V = Flywheel



WS000135

The various components of this ignition system are as follows:

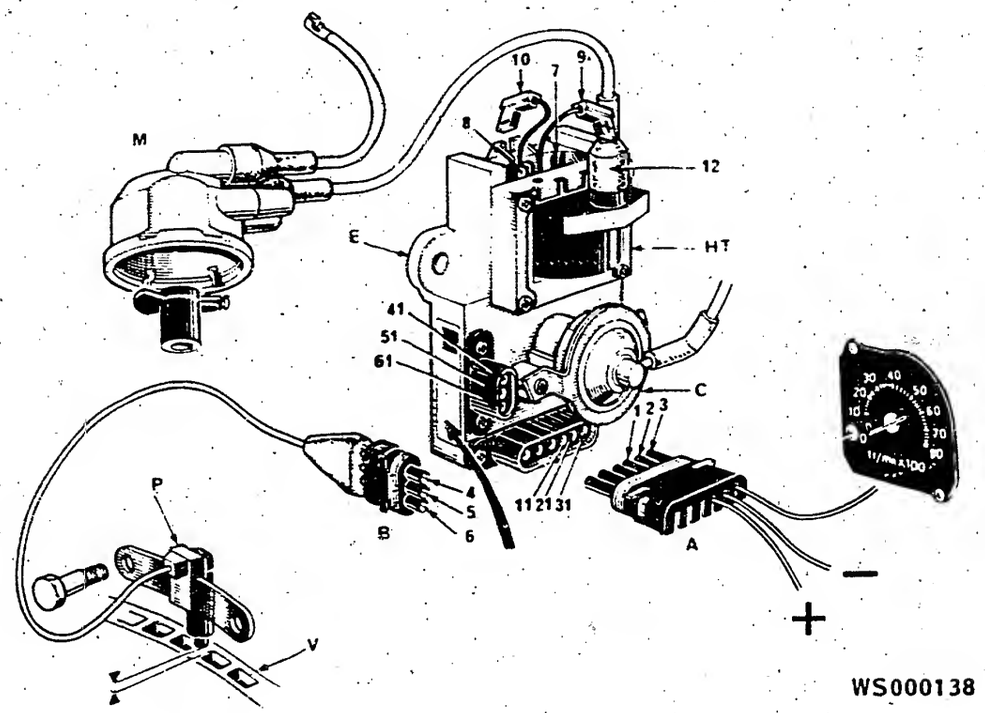
- An electronic control unit (E) which ensures correct interruption and current flow in the primary winding of the ignition coil. On the basis of two parameters, it also determines the ignition timing; this is done on the one hand by means of an inductive engine-speed sensor and, on the other hand, by way of the intake-manifold vacuum (engine load). The control-unit housing also serves as a support for the interchangeable ignition coil from AC-Delco.
  The valid ignition-timing characteristic for the vehicle concerned can be seen from the labelling on the control housing.

- An H.T. distributor which is merely designed to assign the ignition voltage to the spark plugs of the individual cylinders.

WS000139

- Also provided are a knock sensor (top picture), which retards the ignition by up to 6° in the case of knocking combustion, and an engine-speed limiter which interrupts the ignition at 6,200 min^{-1} .

  A vacuum switch in the air line to the charge cooler, which responds at 0.9...1.0 bar, interrupts the ignition in the event of a high charge-air pressure.

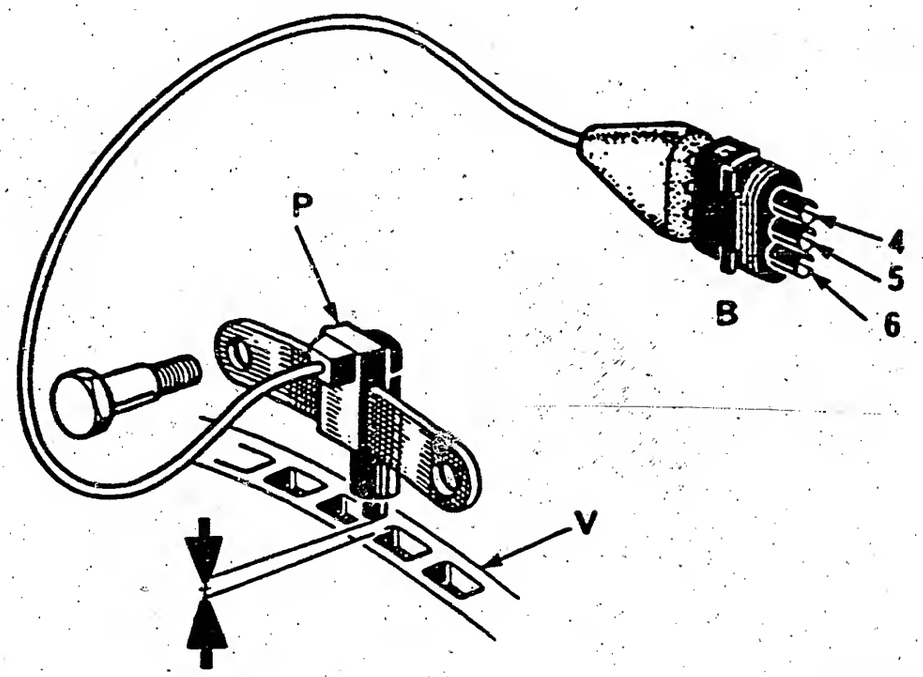


WS000138

5. Trouble-shooting and measurement procedures

With the plug "A" detached (top picture), the ground connection between terminal 2 and vehicle ground is to be measured, as is the continuity between terminals 9 and 11. A figure of 0 Ω must not be exceeded; otherwise the device is to be replaced.

With the plug connected and the ignition switched on, there must be a voltage of > 9.5 V between terminal 9 and vehicle ground; otherwise the plug is to be checked. When both plugs are connected and the engine is cranked with the starter, an indicator lamp connected to the disconnected cables 9 and 10 must flash. If not, the device is to be replaced.



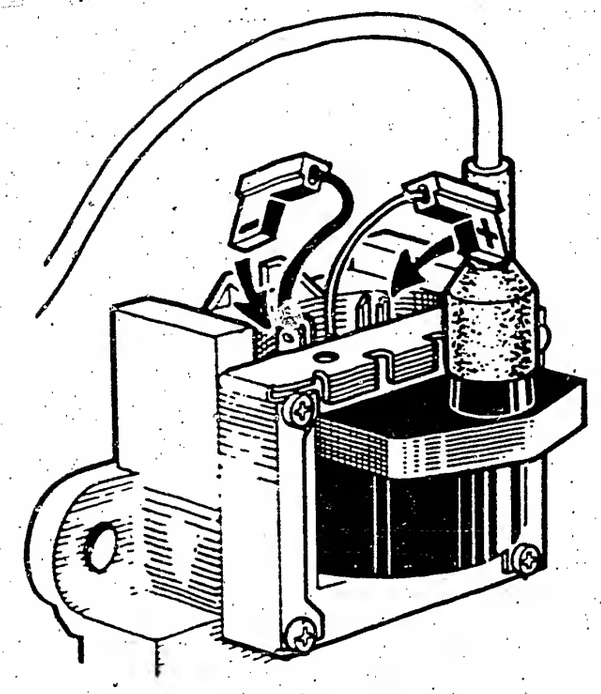
WS000202

P = Pulse generator
V = Flywheel
4 = Generator winding
5 = Generator winding
6 = Screen

The TDC and engine-speed sensor can be tested by effecting measurement with an ohmmeter.

Set value for resistance between:
term. 4 and 5 = 100...200 Ω
term. 5 and 6 = infinity Ω
term. 4 and 6 = infinity Ω
Distance between pulse generator and flywheel = 0.5...1.5 mm

With the engine running, the knock sensor can be checked by tapping gently several times on the cylinder head with a hammer (in the vicinity of the sensor, but not on it). This must cause the ignition point to be retarded by 6°.



WS000140

With connections 9 and 10 detached, the ignition coil can be checked with an ohmmeter.

Primary resistance
(between term. 7 and 8) = 0.4...0.8 Ω ,

Secondary resistance
(between term. 7 and 12) = 3.5...4.5 k Ω

The vacuum unit must not be removed. A calibration of 0.5 mm is provided in the hose connection at the intake manifold.

As a functional check, the engine is to be cranked at 3000 min^{-1} . When the vacuum hose is disconnected, there must be a noticeable drop in engine speed. If not, the hose is to be checked or, if there are no leaks in the hose, the control unit is to be replaced.

The ignition distributor cannot be adjusted.

Firing order 1-3-4-2.

With the C1J760 engine, the ignition point should be

at 650 min^{-1} 6...10°
(with disconnected vacuum unit = 8°);

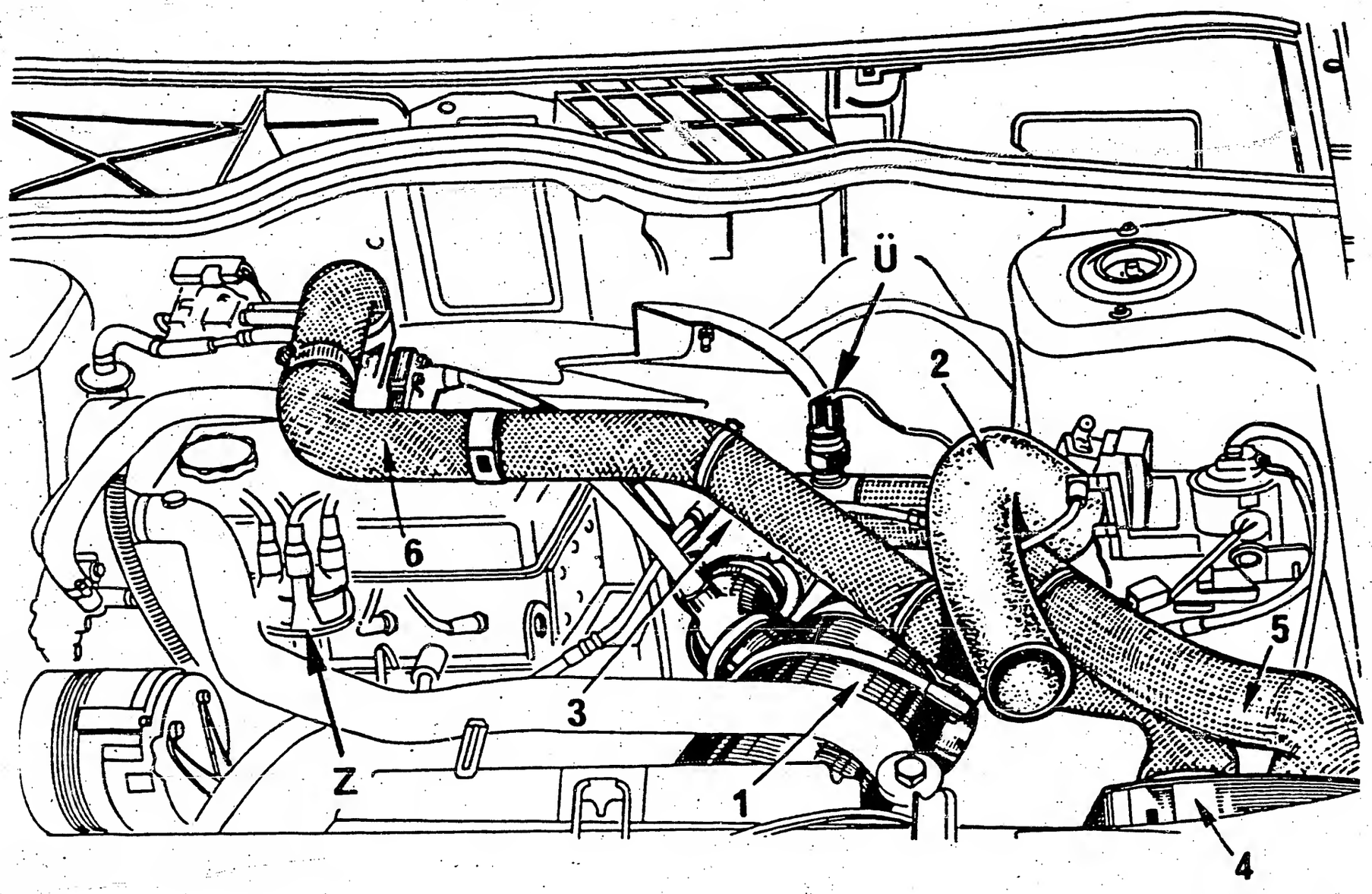
at 1,550 min^{-1} 4... 8° and

at 4,050 min^{-1} 17...23°.

Idle speed: 650 ± 50 min^{-1}

Use is made as spark plugs of Champion N3G or Eyquem 80 LP with an electrode gap of 0.55...0.65 mm.

Champion N9Y are prescribed for the engine type C1J764 (Switzerland).



WS000141

6. Position of pressure-relief switch (Ü) and ignition distributor (Z) on C1J turbo engine

1 = Air filter with thermal control
2 = Cold-start and warm-up intake manifold
3 = Turbocharger
4 = Charge cooler
5 = Air line from turbocharger to charge cooler
6 = Air supply line to carburetor

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RENAULT 11 – 1.7il, catalytic converter, 69 kW,
engine F2N (F3N), year of manufacture 1986

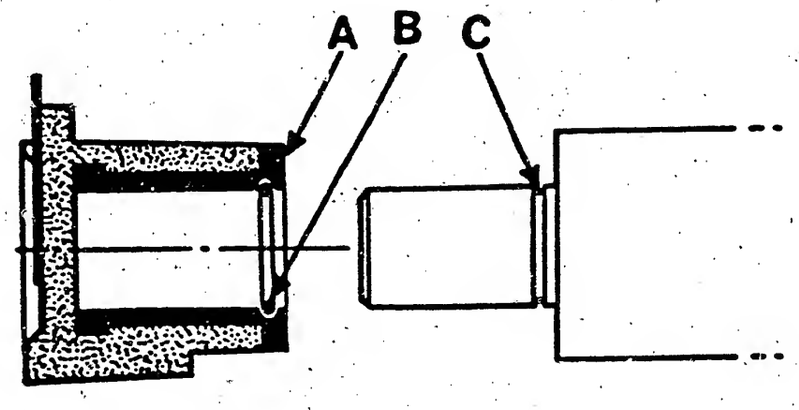
RENAULT 19 – 1.7i, catalytic converter, 55 kW,
engine F2N (F3N), year of manufacture 1988

1. Design and function

The Renix ignition system (AEI) is fully electronic. The flywheel is provided with gear teeth (40 teeth). Two additional teeth are twice as wide and offset by 180° with respect to one another. They are used to determine the TDC position, whereas the normal teeth indicate the engine speed to the control unit by way of the pulse generator with permanent magnet and induction coil fixed to the housing.

The control unit, which also features a vacuum unit, is located at the engine bulkhead. It calculates the most favorable ignition point on the basis of the engine speed, engine temperature and intake-manifold vacuum, and actuates the ignition coil directly with the primary current. The ignition coil is not specially geared to the control unit and can thus be individually replaced.

The rev counter is likewise connected to the control unit.



WS000142

A = Insert
B = Retainer
C = Groove in camshaft extension

2. Special features of ignition distributor

The distributor is merely responsible for distributing the high voltage in the specified firing order (1-3-4-2) and cannot be adjusted. The distributor rotor may be bonded onto the camshaft. If it has to be replaced, it is then to be loosened by turning it with a pair of pliers. The plastic wall is subsequently to be destroyed, so as to facilitate removal of the distributor rotor.

Important:
Never bang on camshaft!
Never bond a distributor rotor with retainer B onto camshafts with groove C (top picture)!

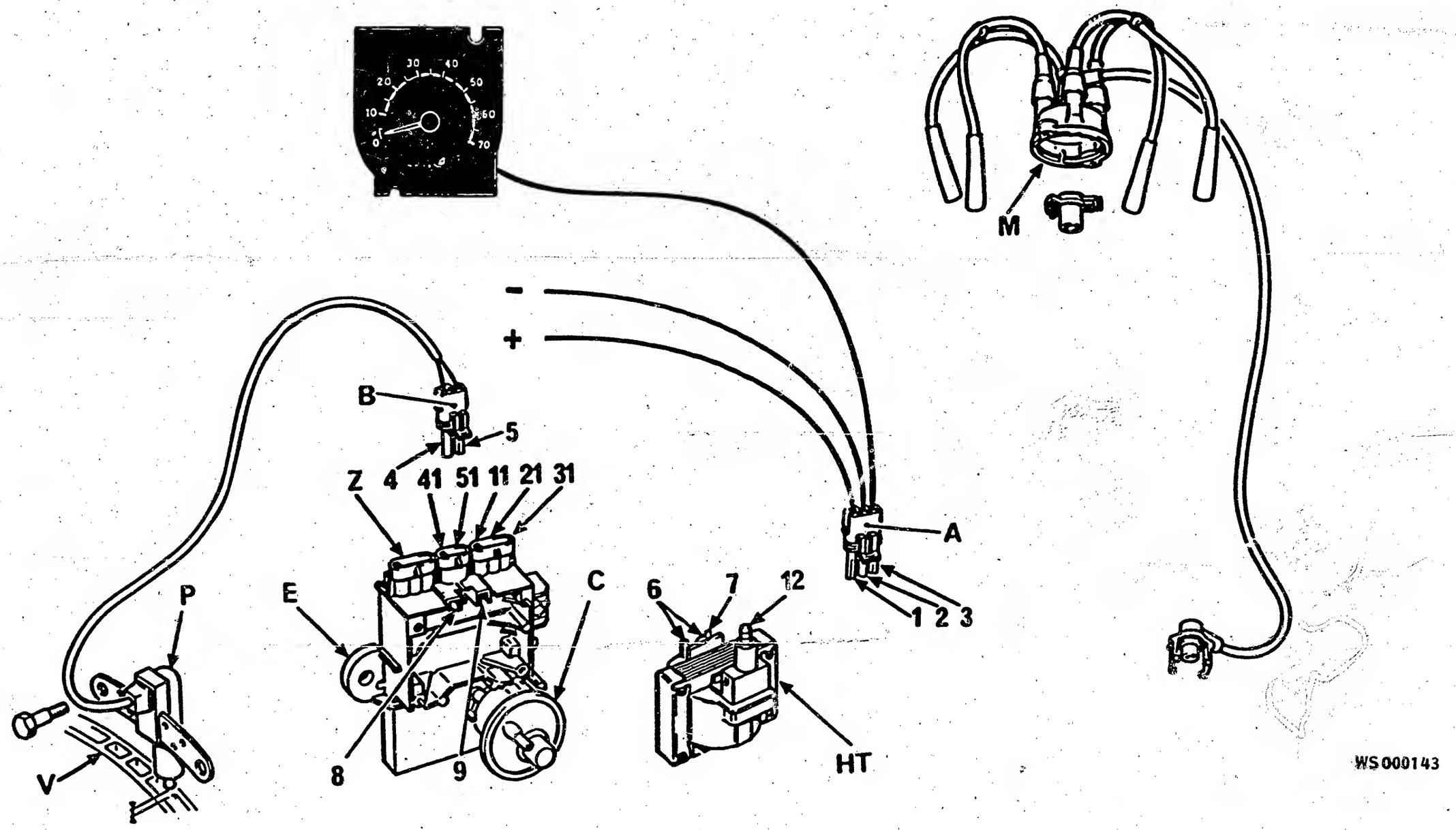
3. Safety precautions

- Never allow high voltage to spark over on to electronic ignition module.
- Do not ground primary and secondary connections of ignition coil.
- Never start engine with battery terminals disconnected.
- Do not effect starting with fast charger.
- Do not disconnect battery with engine running.
- Remove control unit at temperatures in excess of 80°C (stove enamelling).
- Disconnect battery before performing electric welding work.
- Plug of control unit is neither to be disconnected nor connected with ignition switched on.

4. Testers

The ignition system can be checked with conventional equipment such as

- Voltmeter and ohmmeter
- Test lamp and timing light.



5. Ignition system with plugs A and B

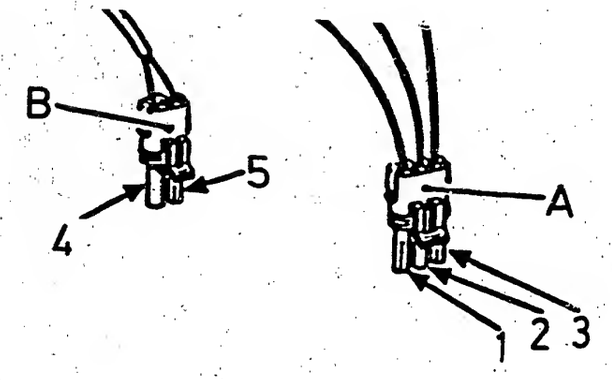
1 = Current supply +
2 = Ground
3 = Rev counter
4 = Pulse-generator connection
5 = Pulse-generator connection
6 = Terminal, ignition coil + and interference-suppression capacitor
7 = Terminal, ignition coil -
8 = Contact, ignition coil +
9 = Contact, ignition coil -
11 = Power supply, ignition module +
12 = High-voltage connection
21 = Ground
41 = Input, pulse generator
51 = Input, pulse generator
C Vacuum unit
E = Control unit
M = Distributor cap
P = Pulse generator
V = Flywheel
Z = Connection, ignition correction
HT = Ignition coil

6. Trouble-shooting and measurement procedures

a) If there is no ignition voltage present

- First visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- Detach plugs A and B (see picture), clean pins if necessary and insert and remove plugs several times.

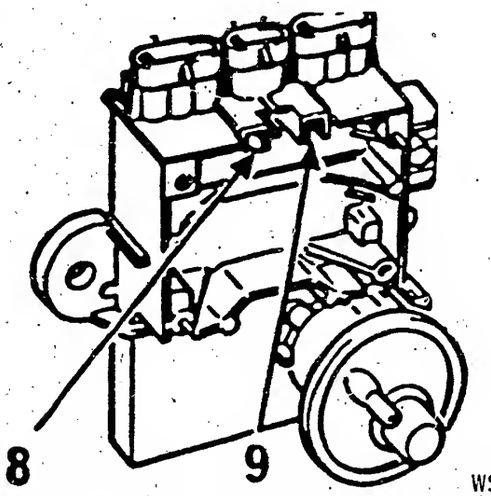


WS000192

Measurement conditions	Measurements	Diagnosis
Detach plug A, switch on ignition Operate starter	Control-unit voltage between +connection and vehicle ground = > 9.5 V	Check battery voltage Check current supply to control unit
	"Go"	
Detach plug A, switch off ignition	Resistance between plug ground and vehicle ground = 0 Ω	Check ground cable of control unit
	"Go"	
Detach plug A, switch off ignition	Voltage at ignition coil = 0 V	Replace control unit
	"Go"	
Connect plug A, switch on ignition	Plug connection and vehicle ground = > 9.5 V	Check plug contacts and connection to ignition coil
	"Go"	

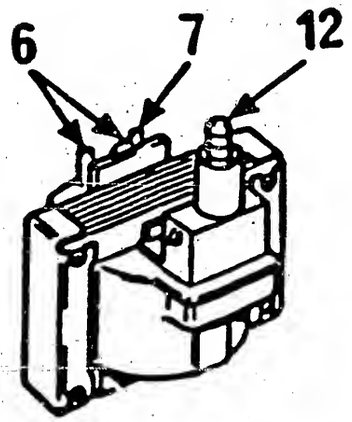
Trouble-shooting and measurement procedures (continued)

Measurement conditions	Measurements	Diagnosis
Detach plug B, switch off ignition	Pulse-generator resistance = 200 ± 50 Ω	Replace pulse generator
	"Go"	
	Distance between pulse generator and flywheel = 1 mm ± 0.5	Replace pulse generator
	"Go"	
Plugs A and B connected, ignition coil detached, starter cranking	Indicator lamp connected between cables 8 and 9, must flicker	Replace control unit
	"Go"	
Ignition coil removed (bottom picture)	Resistance of secondary winding = 2-12 k Ω	Replace ignition coil
	"Go"	
Ignition coil removed	Resistance of primary winding 0.4-0.7 Ω	Replace ignition coil
Plug A detached	Insulation of rev counter = > 20 k Ω	Replace wiring harness or rev counter
	"Go"	
	No secondary voltage	Replace control unit



WS000197

6 = Term., ign. coil + and interference-suppression capacitor
7 = Term., ignition coil



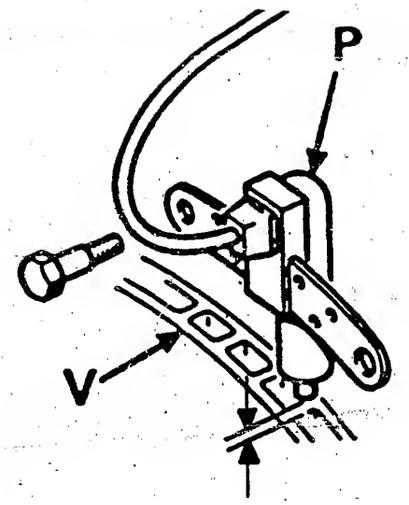
WS000193

b) Starting problems, however trouble-free with engine running

- Visually inspect spark plugs, ignition cables, distributor cap, secondary cable and ignition coil.

- High-voltage check with spark tester.
  Spark length = at least 2 cm.

Operate starter	Powerful, uniform spark; if not, voltage of control unit = > 9.5 V	Control unit, condition of batt. or charge
	"Go"	
	Carburetor or injection, compression, ignition point	
	"Go"	
	Resistance of pulse generator (term. 4 and 5, bottom picture) = 200 ± 50 Ω	Replace if defective
	"Go"	
	Distance between pulse generator and flywheel = 1 ± 0.5 (top picture)	Replace if incorrect



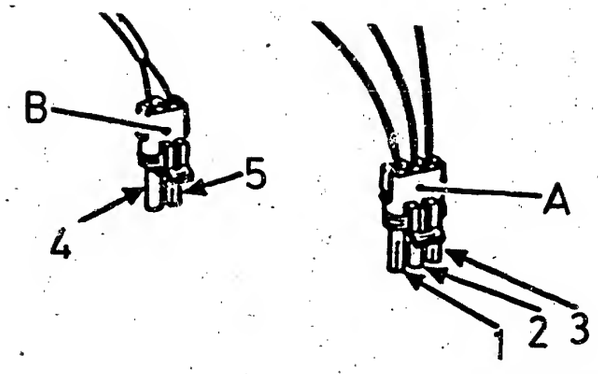
WS000194

P = Pulse generator
V = Flywheel

c) Check on vacuum unit

- Stabilize engine speed at 3000 min $^{-1}$.

- Detach vacuum hose:
  If engine speed decreases, vacuum unit is O.K.
  If there is no reduction in engine speed, check vacuum hose.
  If vacuum hose is O.K., ignition module must be replaced.



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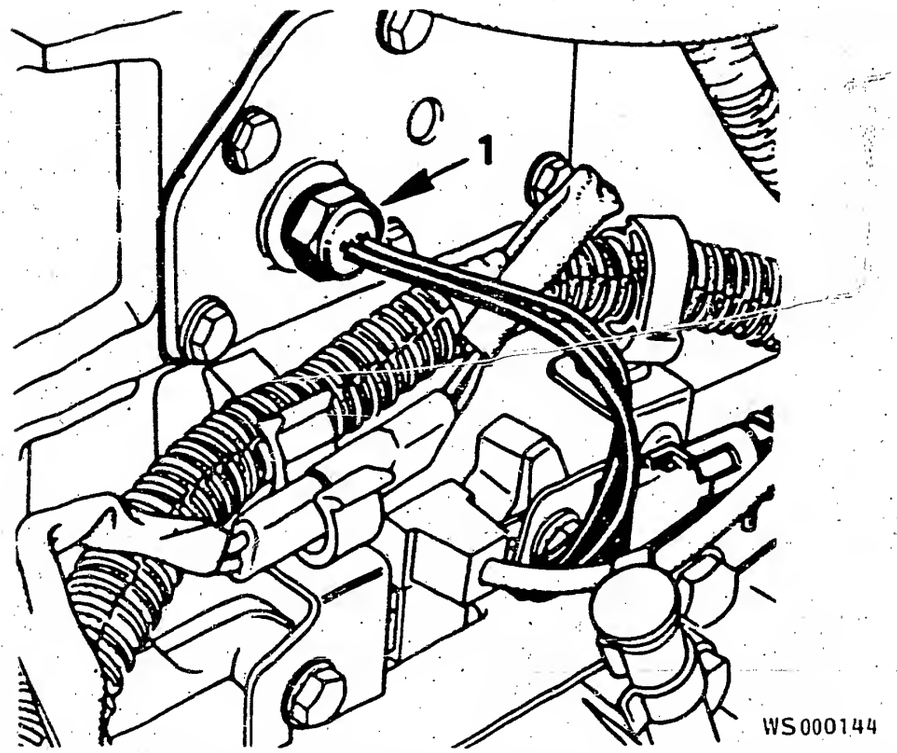

Position of coolant-temperature sensor at engine block

d) Coolant-temperature sensor

The coolant-temperature sensor, which is connected to the ignition module by way of a lead, alters the vacuum timing control between 1200 and 4700 min^{-1} as follows:
Temperature < 90°, vacuum 0 – 270 mbar,
Advance = 0°
Temperature > 90°, vacuum 0 – 270 mbar,
Advance = $-3 \pm 2°$.

This timing-control correction reduces engine knock under difficult operating conditions.

Spark plugs: AC C 41 CXLS; Champion N 279 YC;
electrode gap 0.75...0.85 mm.

This microcard was prepared exclusively for Bosch Service on behalf of ROBERT BOSCH GMBH STUTTGART

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Ingenieurbüro für Auto-Technik

Drawn up on the basis of a publication by the same author which appeared in the "Auto-Technik" magazine published by the AT-Fachschriftenverlag AG, CH-5001 Aarau.

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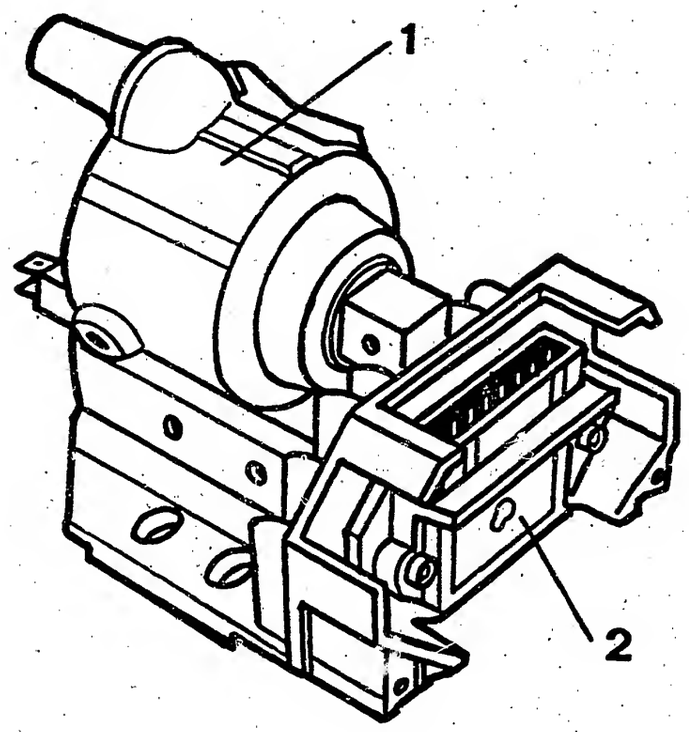
ALFA ROMEO "Alfa 2.0 Turbo"
with Microplex ignition

Whereas the normal 2.0 liter and the V6 engine of the Alfa 164 feature the Motronic, the 2.0 liter Turbo with no catalytic converter employs the BOSCH LE-2 Jetronic and Microplex ignition from Magneti Marelli.

This unit is also to be found on other Italian passenger cars.

BOSCH injection and Marelli ignition both require their own control unit. A speciality of this engine is the overboost system which makes it possible to increase the engine torque for 30 secs by 20 Nm to 285 Nm when the accelerator pedal is fully depressed. The increase in charge-air pressure required for the above is achieved by delayed opening of the waste-gate.

The ignition system receives information on crankshaft position and engine speed from two separate sensors: the TDC sensor on the end face of the engine (crankshaft pulley) and the engine-speed sensor on the back of the engine (flywheel).

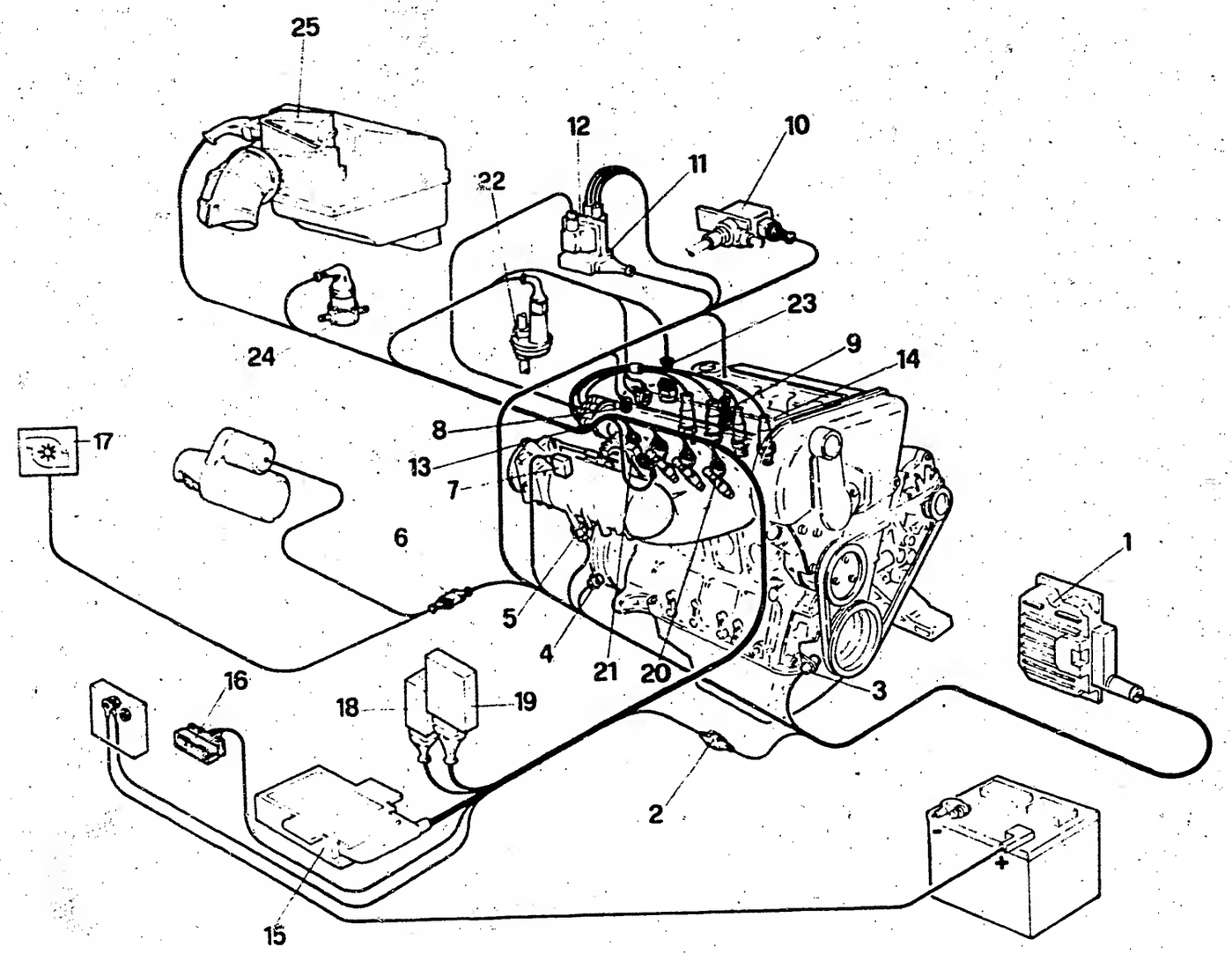


WS000080

1 = Ignition coil
2 = Ignition trigger box

The ignition control unit is connected to the intake manifold by means of a vacuum hose. It regulates the ignition point on the basis of stored characteristic curves.

The ignition trigger box and ignition coil form a single unit (see picture). High-voltage distribution is effected in the normal manner by means of an ignition distributor.



WS000203

Injection and ignition system of Alfa 164 2.0 liter Turbo engine

1=Ignition control unit
2=Ignition-injection cable connection
3=TDC sensor
4=Engine-speed sensor
5=Safety switch, charge-air pressure
6=Cable connection for overboost indicator lamp and starter signal
7=Full-load switch
8=Ground, ignition distributor
9=Knock sensor
10=Overboost-solenoid valve
11=Ignition module
12=Ignition coil
13=Ignition distributor
14=Spark plug
15=Control unit, injection
16=Connection-instrument panel
17=Indicator, overboost
18=Relay, rev counter
19=Full-load enrichment
20=Injection valve
21=Throttle-valve switch
22=Auxiliary-air device
23=Coolant-temperature sensor
24=Auxiliary-air valve
25=Air-flow sensor

1. Safety precautions

- Never disconnect battery with engine running.
- Never use a fast charger to start engine.
- Disconnect battery from vehicle power supply when effecting fast charging.
- Remove control unit when performing stove enamelling (temperature in excess of 80 degrees)
- Disconnect battery before performing electric welding work.
- Never remove or insert plug of control unit with ignition switched on!

2. Testers

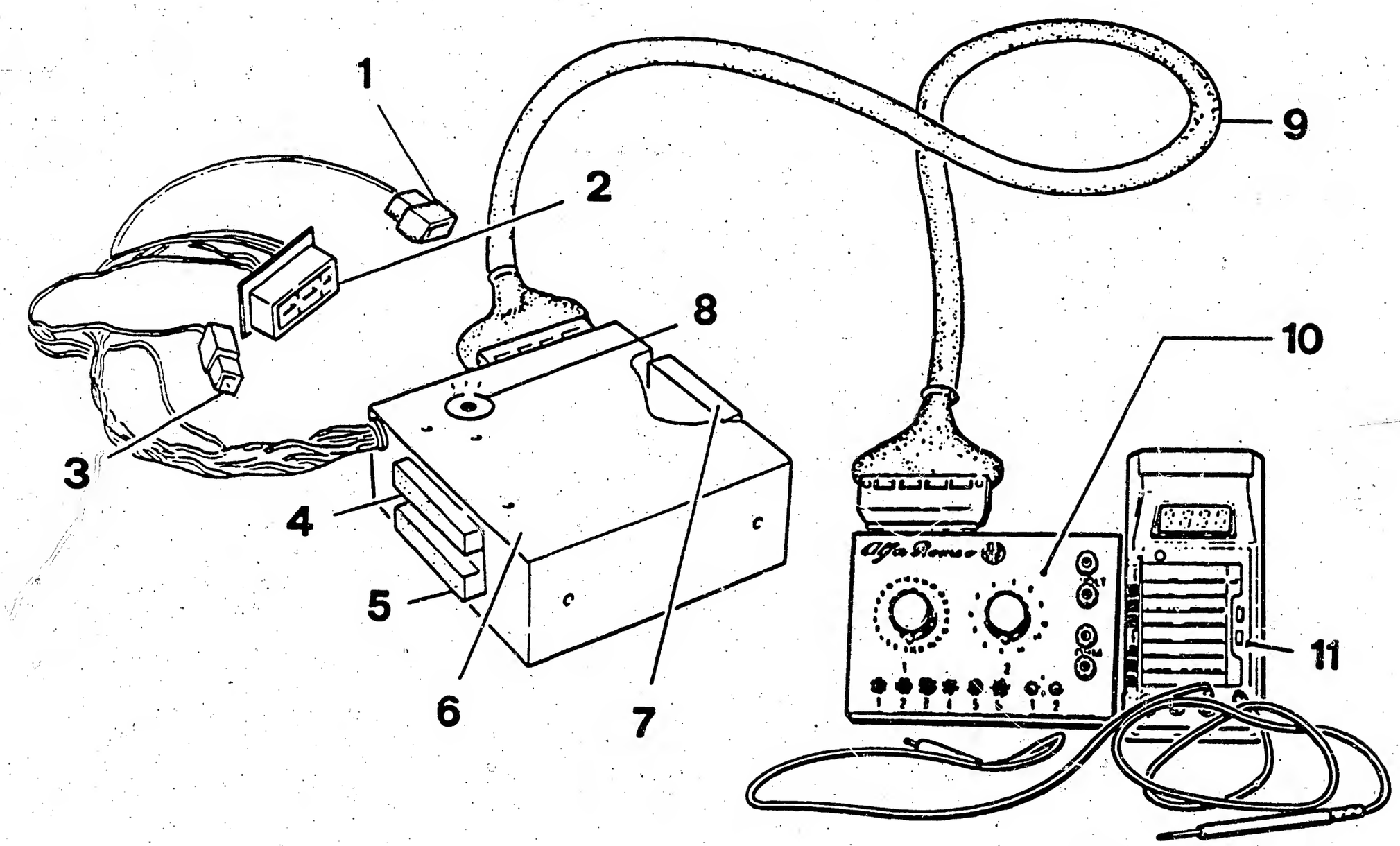
A special tester set is available for in-depth system testing with prescribed test steps (see picture, Coordinate 07/08).

The Microplex can also be checked with a voltmeter and ohmmeter, a timing light and rev counter, and a vacuum gage and vacuum pump.

3. Position of control units

The LE-Jetronic control unit is located beneath the center console and is accessible from the passenger side.

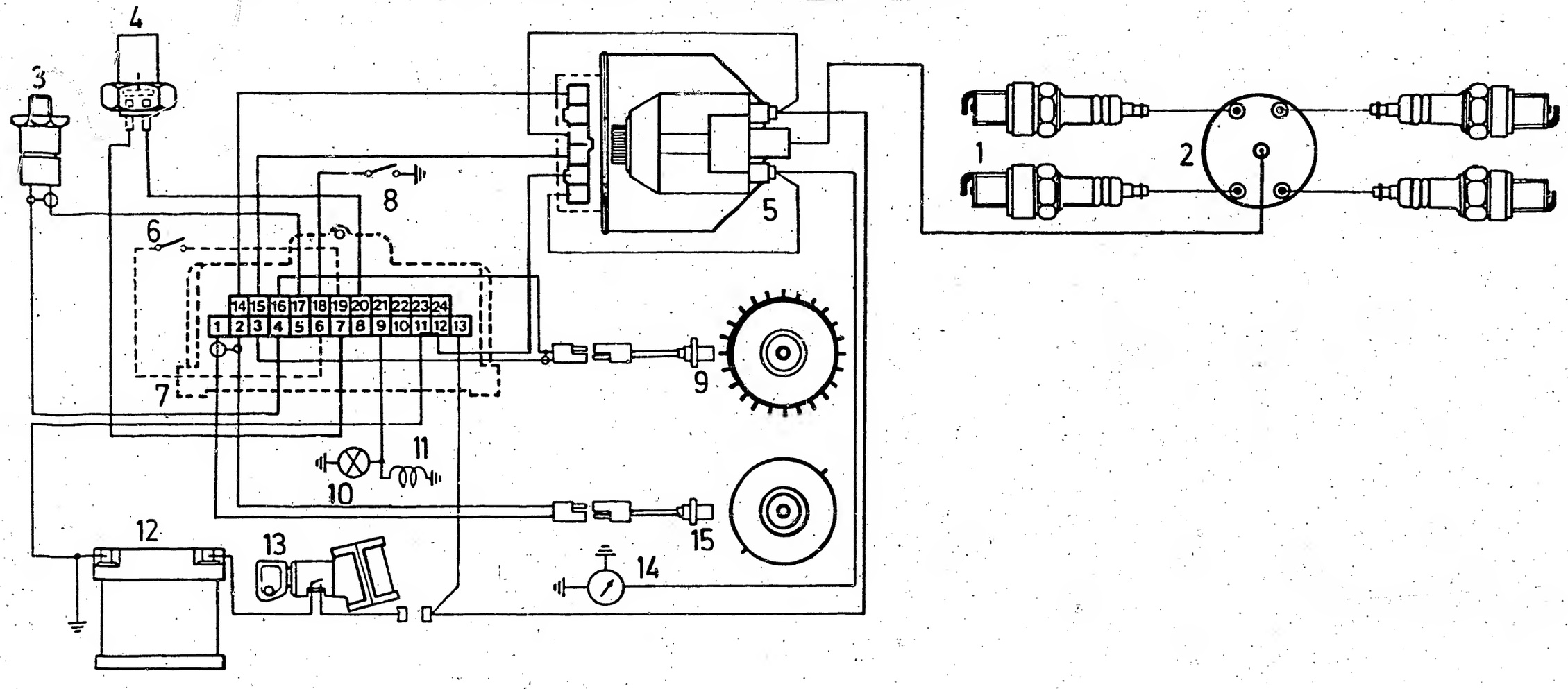
The control unit of the Microplex system is bolted to the inside of the right-hand fender.



WS000205

Tester set for checking ignition and fuel-injection system:

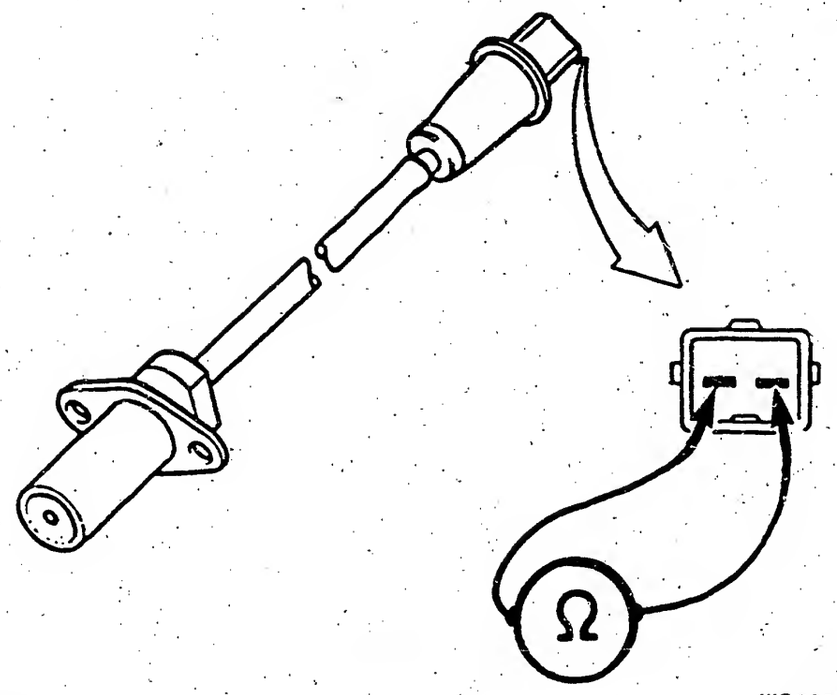
1 = Output, engine-speed signal
2 = Connection, full-load enrichment unit
3 = Power supply
4 = Connection, Microplex ignition
5 = Connection, EI-20K ignition
6 = C 10132
7 = Connection, LE-2 Jetronic
8 = Selector switch
9 = C 90032
10 = C 10132
11 = Multimeter



WS000204

Design of Microplex ignition:

1 = Spark plug
2 = Ignition distributor
3 = Knock sensor
4 = Safety switch, charge-air pressure
5 = Ignition coil with trigger box
6 = Ground switch, ignition retard
7 = Control unit
8 = Full-load switch
9 = Engine-speed sensor on flywheel
10 = Overboost indicator lamp
11 = Overboost control valve
12 = Battery
13 = Ignition switch
14 = Rev counter
15 = TDC sensor on crankshaft V-belt sprocket



WS000206

4. Tests and adjustments

Before tests are performed on the ignition system, it must be ensured that the engine (compression and valve clearance) and all air/vacuum lines are OK.

4.1 Testing of individual components

a) TDC and engine-speed sensor

Resistance test 600...800 ohms at 20 ° C,
800 ohms may be exceeded with a warm engine.
Correct distance from timer core:

TDC-sensor	0.4...1.0 mm
Engine-speed sensor	0.25...1.3 mm

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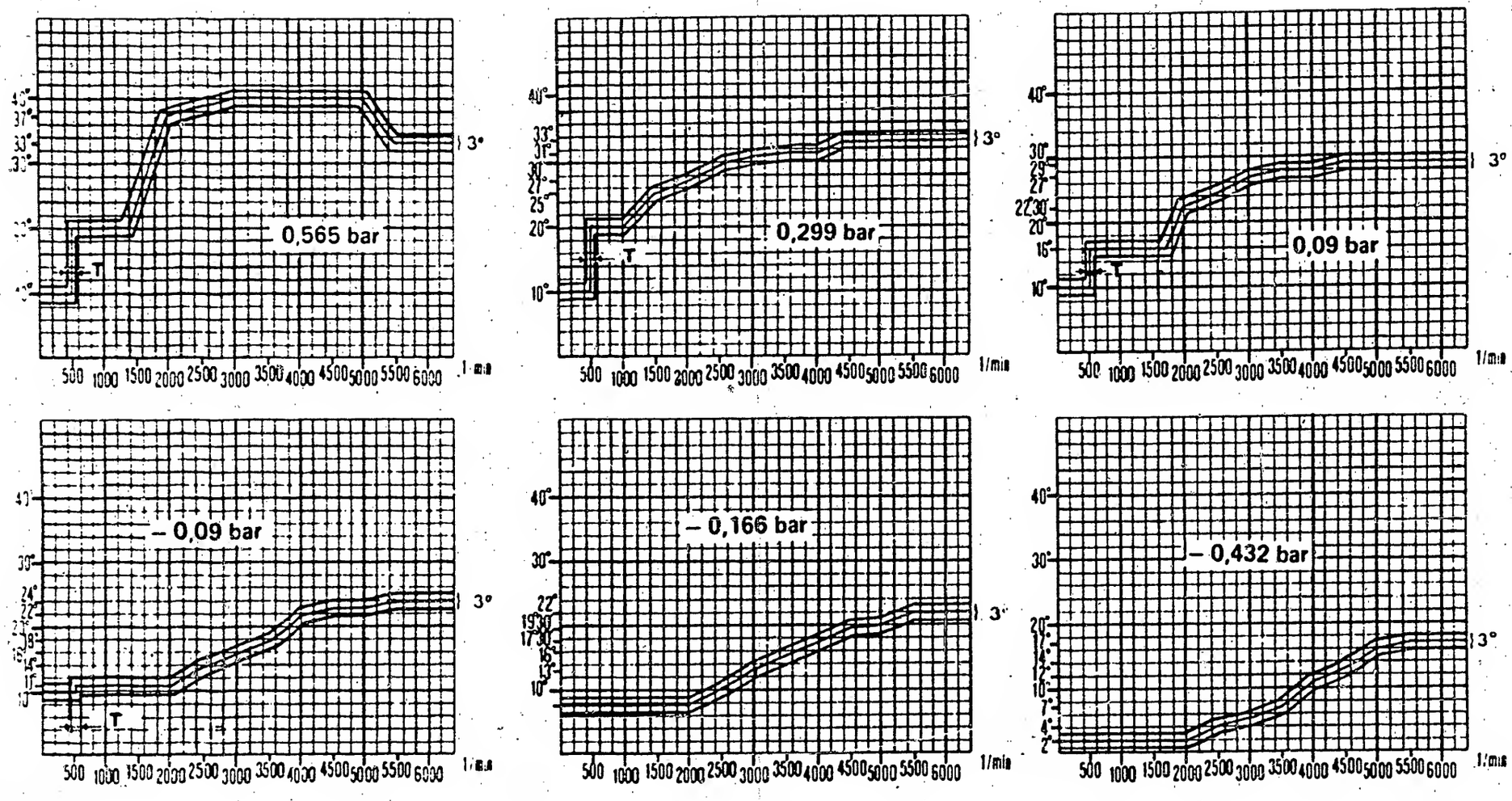


WS000207

Ignition–advance characteristic curves at various intake–manifold pressures, top positive pressure (charge–air pressure), bottom negative pressure.

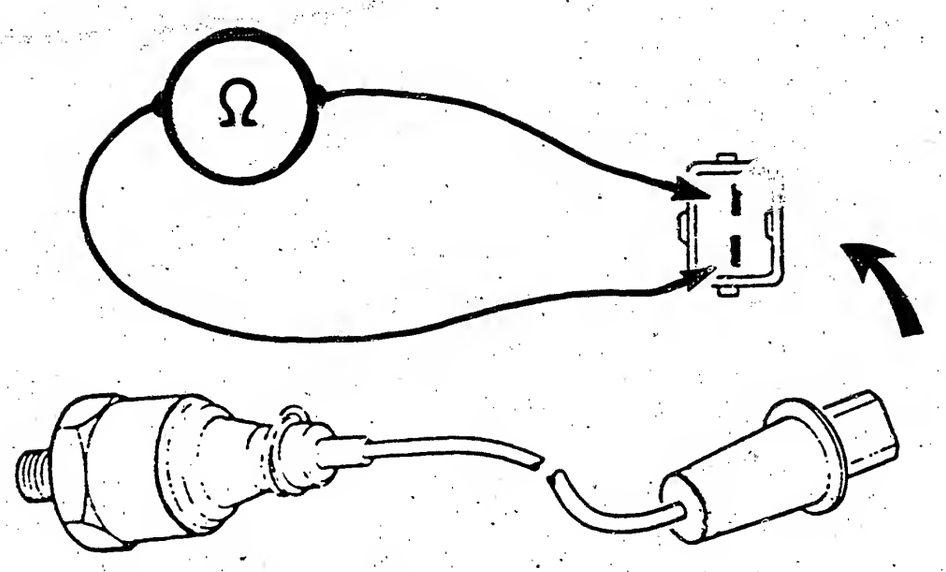
b) The ign. point when idling and at various speeds/loads can be checked on the basis of the marks on crank–shaft pulley and the control–chain housing, as well as with the aid of the ign. timing graphs (top picture). The ign. point is specified by the TDC–sensor position. It cannot be adjusted. The ign. point must be 20° when idling (750 $\pm$ 50 min $^{-1}$). In the event of deviations, a check is first to be made on the vacuum line between intake manifold and ignition control unit. The teeth of the flywheel (pulse–generator ring gear) are also to be checked. Never turn the ign. distributor!

c) The voltage supply of the control unit is to be checked with a voltmeter between term. 13 and ground with the plug detached and the ignition switched on.

Set value = battery voltage

If this is not the case, then check plug connections, leads and ground connections.

The battery voltage must likewise be applied to the trigger box of the ignition coil. If not, check plug connections as well as leads to ignition lock and battery.



WS000208

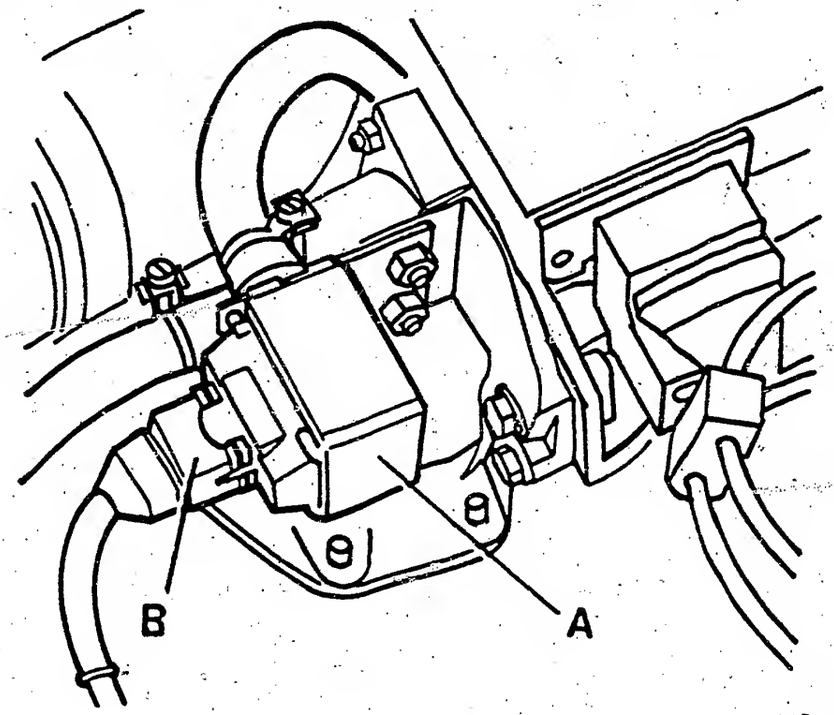
d) The primary and secondary resistance is to be measured at the ignition coil.

Set values: primary 0.310 ... 0.378 Ω
secondary 3.3 ... 4.1 k Ω

There is no continuity between the terminals of the knock sensor.

In the event of a knocking engine (can be simulated for test purposes by tapping gently with a hammer), the ignition point must be retarded.

Resistance of knock sensor: infinity Ω



WS000209

A = Overboost solenoid valve
B = Plug connection

e) To check the waste-gate, connect a compressed-air line with pressure gage to the valve pressure chamber. If a pressure of 966 ± mbar is applied, the rod travel must be 1.27 mm. Adjustment can be effected by loosening the end of the rod and turning the rod itself.

To perform a functional check, the overboost solenoid valve (top picture) is to be connected with the plug detached to a 12 V current source and grounded. If the valve is intact, the opening and closing must be clearly audible.

f) The control unit and the trigger box are only to be renewed if testing of the entire periphery reveals no faults. First of all merely the trigger box is to be replaced.

4.2 Adjustments

a) Idle adjustment is effected by means of the bypass screw on the top of the throttle housing (engine speed) or by means of the hexagon-socket-head cap screw on the air-flow sensor (mixture)

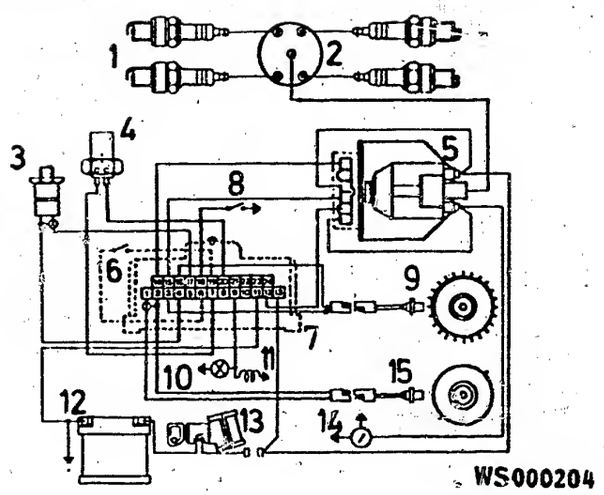
Table I: Technical Data

Spark plugs	Champion RN7YC or Bosch WR6DC
Electrode gap	0.6 ... 0.7 mm
Tightening torque	37 Nm
Ignition module	Marelli Microplex MED 601 B
Ignition distributor	Marelli DT 402 AX
Firing order	1–3–4–2
Ignition point	20° before TDC at idle speed, not adjustable
Ignition coil	Marelli AEI 500 B
Primary resistance	0.310 ... 0.378 Ω at 20°C
Secondary resistance	3.300 ... 4.070 k Ω at 20°C
Idle speed	750 ± 50 min $^{-1}$
CO content	1.5 ± 0.5 vol.%

Table II: Test locations and test conditions

To be tested:	Terminals	Conditions	Test specifications
Ground of ignition control unit	St 11 – ground	Ignition off	5 Ω
Ignition-control-unit power supply	St 13	Ignition off Ignition on	0 volts Batt. voltage
TDC-sensor		Engine cold	600–800 Ω
Engine-speed sensor		Engine cold	600–800 Ω
Knock sensor			infinity Ω
Safety switch max. turbo pressure	St 7 – St 20		infinity Ω
Start signal	St 4	Ignition on Starter operated	0 volts Batt. voltage
Relay, rev counter	30 – 31 87 – 31		Batt. voltage Batt. voltage

St = Wiring-harness plug



1 = Spark plug
2 = Ignition distributor
3 = Knock sensor
4 = Safety switch Charge-air pressure
5 = Ignition coil with trigger box
6 = Ground switch, ignition retard
7 = Control unit
8 = Full-load switch
9 = Engine-speed sensor on flywheel
10 = Overboost indicator lamp
11 = Overboost control valve
12 = Battery
13 = Ignition switch
14 = Rev counter
15 = TDC-sensor on crankshaft V-belt sprocket

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J. Pfyl-Ing. HTL
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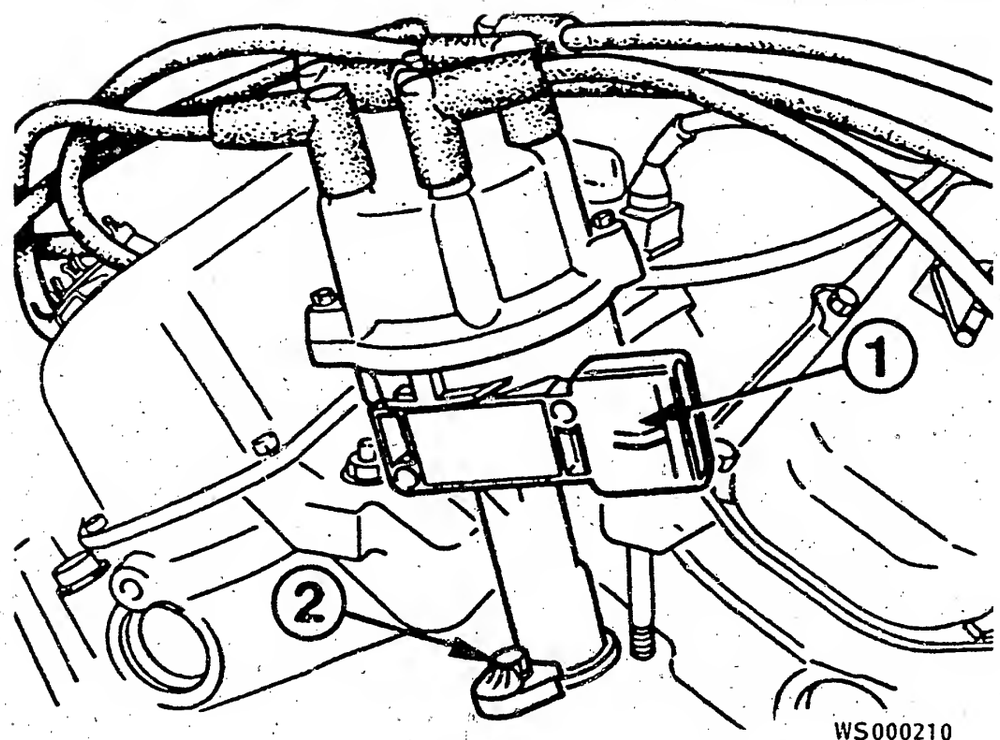
Ford Sierra and Granada 2.8l V6 and
2.9l V6 cat. engine as of 1987

The ignition system in these V6-HC-EFI engines consists of an ignition distributor with Hall generator and a distributor cap with high contact stability, a TFI (Thick Film Integration) ignition module and a high-performance ignition coil.

The TFI ignition module is attached to the ignition-distributor housing.

The fastening screw of the ignition distributor is sealed during production, since the initial ignition-timing adjustment is not intended to be changed.

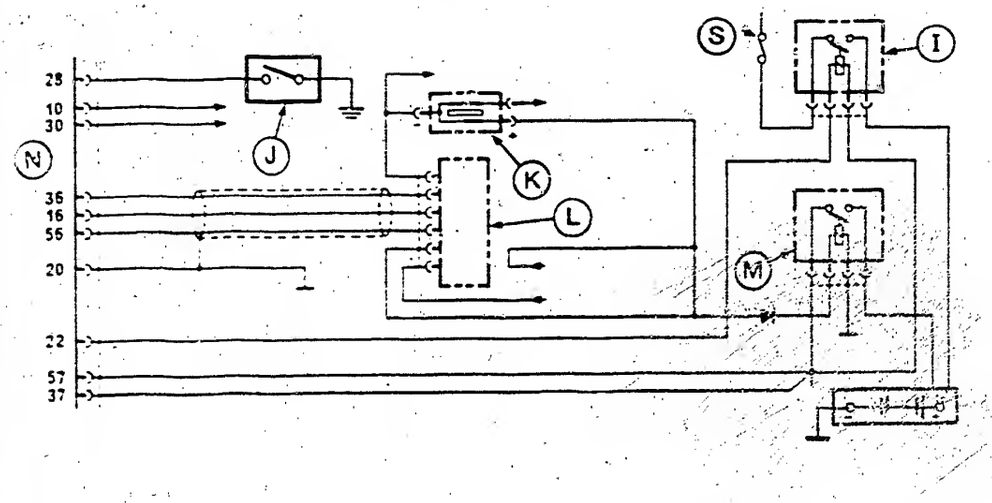
Re-adjustment of the ignition point may only be carried out following repairs or if the ignition distributor has been renewed.



1 = TFI ignition module
2 = Fastening screw

N01 ——— ==>

N02 ——— <==>



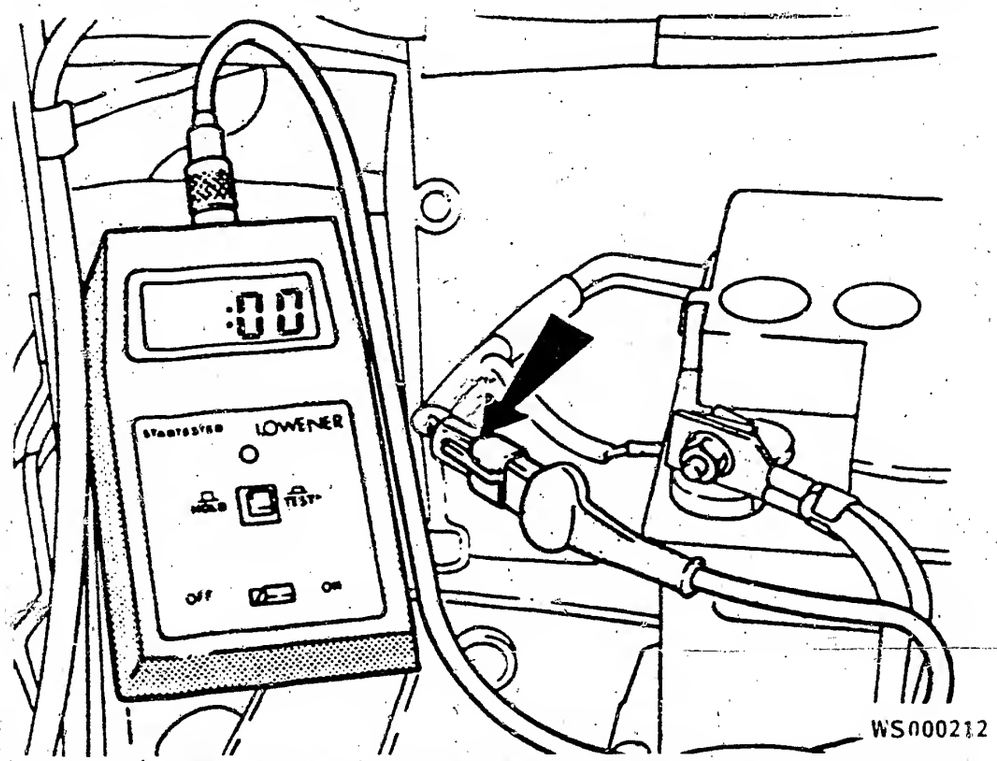
WS000211

K = Ignition coil
L = TFI ignition module
M = EEC IV supply relay
N = Control unit EEC IV
I = Fuel-pump relay
J = Fuel-temperature switch

The Hall generator in the ignition distributor constantly transmits information signals on engine speed and crankshaft position via the TFI ignition module to the EEC IV control unit which is combined with the fuel injection. This control unit also contains the ignition timing maps. The engine speed, load and engine temperature are used by the control unit to calculate the exact ignition point, and the ignition signal is then transmitted to the TFI ignition module. This module interrupts the primary current in the ignition coil and thus triggers the high-tention spark. If no ignition signal is given on account of a fault in the system, the ignition coil is switched directly by the TFI module.

1. Safety precautions

- Disconnect battery when fast charging.
- Remove control unit when performing stove enameling at temperatures in excess of 80°C.
- Never use a fast charger to start engine.
- Do not disconnect battery with engine running.
- Module plug is neither to be removed nor connected with the ignition switched on.
- CAUTION: 25% higher H.T. than before!



Tester (Star Tester) connected to the diagnosis plug (arrow) located in the vicinity of the battery.

2. Testers

A test box with test cable, which is to be used in conjunction with a rev counter and multimeter, is available for performing self-diagnosis.

The individual components can also be checked using the last two pieces of equipment mentioned above and a timing light.

A vacuum hand pump is required for checking the vacuum advance.

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3. Tests

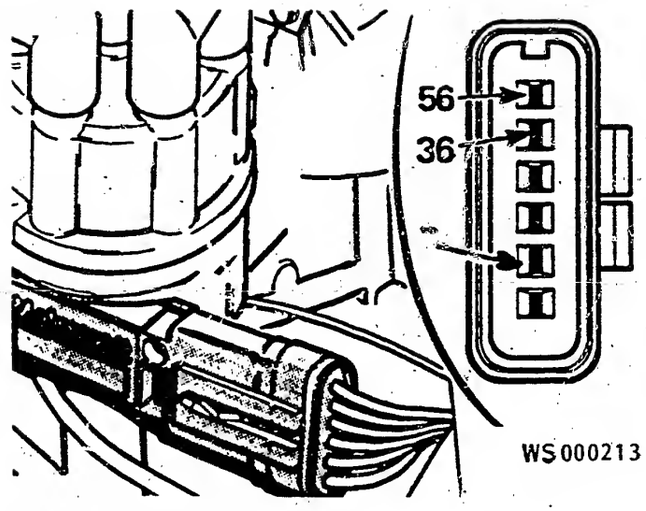
Before starting to test the electronic ignition system, a pre-check should be carried out to establish whether:
- all electrical connections and the vacuum line are o.k.
- compression and valve clearance are within tolerances
- high tension is being applied to the spark plugs; 8...14 kV, when idling, 20 kV at 3000 min $^{-1}$.

a) In the event of starting problems, a check is to be made as to whether there is a voltage of at least 7 V at the ignition coil on operating the starter. If this is not the case, the battery and the leads to the ignition coil are to be checked.
Whether or not the ignition generator switches the ignition-coil current on and off it can be tested on starting with a test lamp, which is to be connected to the two ignition-coil terminals. To make absolutely certain, the ignition-coil resistance is likewise to be measured.

b) In the event of misfiring, the ignition point is to be subjected to an extremely precise check using a timing light. The ignition point is set at the factory to exactly 0.5°. Should deviations occur, a check is to be made as to whether the sealing of the ignition-distributor lamping screw is still o.k. It is also necessary to test that the position of cylinder no.1 actually corresponds to the basic setting.
Detach multiple plug from ignition distributor and check cable (Term. 36) for continuity. Set value 4.5....5.0 k Ω .
Check TFI control unit for short to ground (Term. 40 – not on top picture). Tolerance value 0...1 Ω . Renew TFI module in both cases if fault cannot be eliminated.

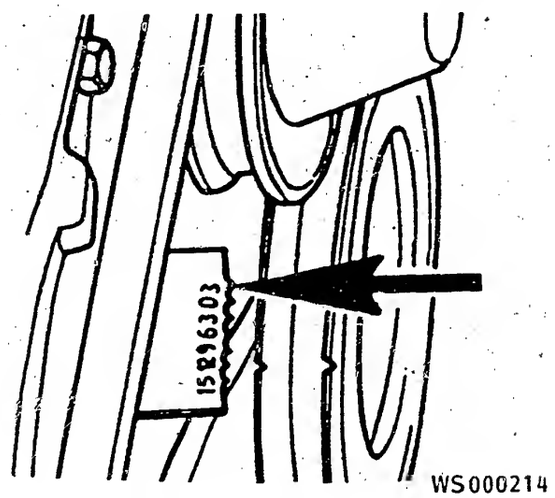
Important: Proceed with caution when removing and installing the TFI module in the ignition distributor, so as to ensure that the contacts are not damaged. The back of the new module is to be coated with thermal conduction compound prior to installation.

c) Check ignition timing. Once the engine has reached operating temperature, it is to be revved up to a speed of 2000 min $^{-1}$. The vacuum hose should then be disconnected and the engine accelerated. The ignition must be advanced when the timing light is pointed at the TDC mark on the crankshaft V-beltsprocket. If the vacuum-hose clamp is detached for the 2nd check, the ignition must be further advanced by a few degrees corresponding precisely to the vacuum advance angle.



Multiple plug at TFI ignition module of ignition distributor with terminal designations for continuity and ground check

TDC and ignition-point marks on crankshaft V-belt sprocket

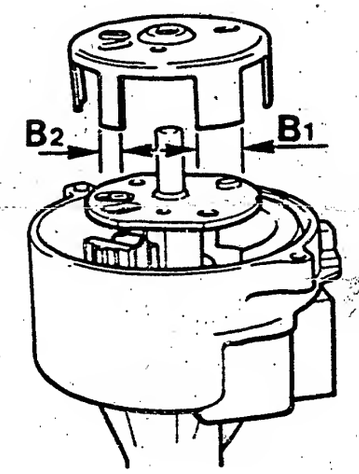


4. Settings

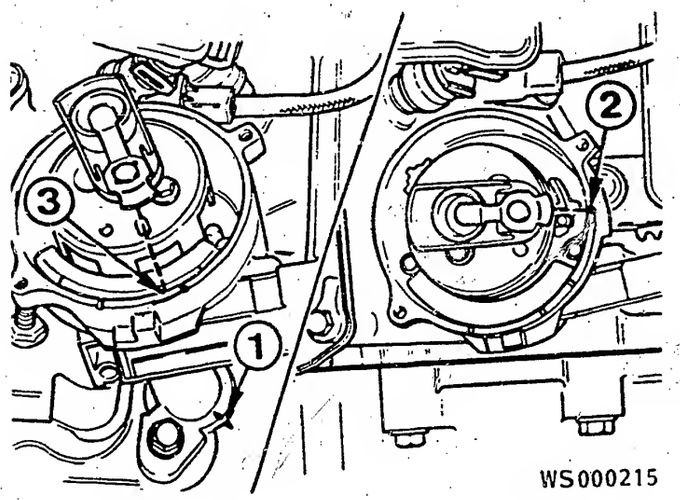
The task of the Hall generator is not only to indicate the engine speed and TDC to the control unit, but also to effect cylinder identification. For this reason, the vane for cylinder no. 1 (B 2) on the trigger wheel (top picture) is narrower than the vanes for the other 5 cylinders (B 1). On the basis of this cylinder identification, the EEC IV control unit alternately releases injection for the two injection-valve groups 1-2-4 and 3-5-6 with each revolution of the crankshaft. This is why the ignition distributor has to be set very precisely should it have been removed.

When crankshaft and camshaft are in TDC position, the ignition distributor is to be inserted such that the notches on the bottom of the distributor and on the engine block (center picture, 1) are in alignment with one another and such that the distributor rot points towards the notch (center picture 2) on the edge of the distributor housing. On being inserted, the distributor rotor is then turned to the position indicated in the picture (3), namely the actual TDC position of cylinder no. 1. In this process, the front edge of the rotor segment must coincide with the Hall generator and the distributor rotor must point towards the ignition-cable connection of cylinder no.1. Correct position of distributor rotor (bottom picture, item 1) and vane of cylinder no. 1 (2) in TDC position of cylinder no. 1, 3 = vane of cylinder no. 4.

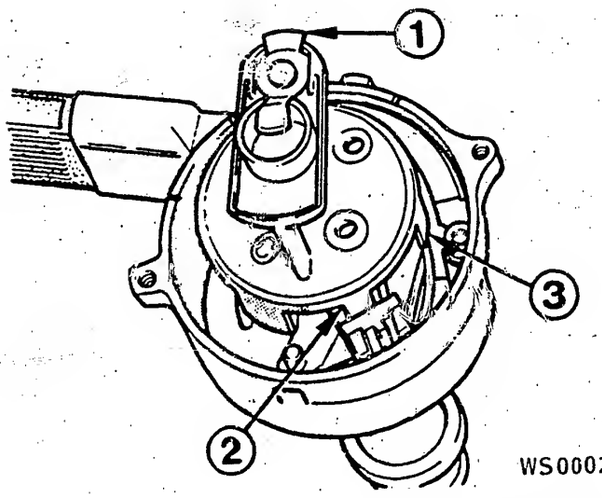
Following adjustment, the ignition point is to be checked again with the timing light with the engine idling. As a final step, the distributor clamping screw is to be sealed with locking compound.



WS000216



WS000215



WS000217

Technical data

Engine type	2.8i	2.9 cat.
Capacity	2.792	2.936
Max. power (kW/min)	104...110/5700	107...110 5500...5700
Max. torque (Nm/min)	216/3800	233/3000
Spark plugs	AGR 22 C	AGRF 42 C/32 C
Electrode gap	0.75 mm	1.00 mm
Tightening torque (Nm)	30 ... 40	30 ... 40
Ignition module	TFI	TFI
Ignition distributor	Motorcraft	Motorcraft
Firing order	1 - 4 - 2 - 5 - 3 - 6	
Ignition point	0°	15° before TDC
Ignition coil	Bosch / Femso / Polmot	
Primary resistance (Ω)	0.72...0.88	0.75...0.85
Secondary resistance (k Ω)	4.5...7.0	5...6
Generator resistance (Ω)	650	
Idle speed	< 900	900/800
CO content at idle	10.5...1.0	0.0 %

This microcard was prepared exclusively for Bosch Service on behalf of ROBERT BOSCH GMBH STUTTGART

J. Pfyl-Ing. HTL
Ingenieurbüro für Auto-Technik

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The BOSCH equipment and the test specifications/ settings for BOSCH products and components are always to be taken from the BOSCH microcards. Test specifications and circuit diagrams are contained in the microcards and workshop documentation already introduced into BOSCH after-sales-service workshops.